COLORADO
Department of Public Health & Environment

May 12, 2020

Mr. Richard Dean
Stratus Redtail Ranch, LLC
8480 E. Orchard Road, Suite 1100
Greenwood Village, CO 80111

RE: **CDPHE Approval of the Corrective Measures Design Report Rev. 1**
Neuhauser Landfill, Erie, Colorado

SW/WLD/NEU 2.4

Dear Mr. Dean:

The Colorado Department of Public Health and Environment ("CDPHE" or "Department") Hazardous Materials and Waste Management Division ("Division") received the following document on May 1, 2020:

> *"Corrective Measures Design Report, Historic Landfill Site, Rev. 1;"* prepared for Stratus Redtail Ranch LLC ("Stratus"); prepared by Geosyntec Consultants ("Geosyntec"); dated May 1, 2020 (referred to herein as the "CMD Rev.1").

Stratus and CDPHE entered into Compliance Order on Consent Number 18-05-15-01 on May 16, 2018 ("Consent Order"). Among other things, the Consent Order requires Stratus to prepare a corrective measures design ("CMD") and a post-closure monitoring and maintenance plan ("PCMMP"). The CMD was originally due on June 5, 2019. Under the Consent Order, the PCMMP is due within sixty calendar days of approval of the CMD. Stratus requested, and the Division approved, Stratus' request to include the PCMMP as an appendix to the CMD. Stratus also requested and the Division approved time extensions for the due date of the CMD. Stratus submitted a draft CMD to the Division on August 27, 2019 for an informal technical review. The Division provided written comments on the draft CMD to Stratus in four separate transmittals between September 10, 2019 and October 7, 2019.

Stratus submitted CMD Rev. 0 to the Division for review on February 7, 2020. The Division advertised a 30-day public comment period starting on February 26, 2020 inviting the public to comment on the CMD Rev. 0. The public comment period ended on March 26, 2020. The Division received no comments from the public. The Division's comments on CMD Rev. 0 were issued to Stratus on April 2, 2020.

The Division has completed its review of the CMD Rev.1. The Division reviewed CMD Rev.1 to determine its compliance with requirements of the Solid Wastes Disposal Sites and Facilities Act, CRS 30-20-100.5 *et. seq*. ("Act"), the Regulations Pertaining to Solid Waste Sites and Facilities, 6 CCR 1007-2, Part 1 ("Regulations"), and the Consent Order. Based on its review, the Division has determined that the Division's comments have been adequately addressed and that the CMD Rev. 1 meets the requirements of the Act,

Regulations, and Consent Order. Therefore, the Division hereby approves the CMD Rev. 1 as submitted.

Please note that this approval letter does not preclude the Town of Erie from taking independent review action.

The Division requests that Stratus submit its closure and post-closure financial assurance cost estimate by August 12, 2020. The cost estimate does not need to include the work to be performed during the summer of 2020.

The Department is authorized to bill for its review of technical submittals at a rate of $125 per hour pursuant to Section 1.7 of the solid waste regulations. An invoice for the Division's review of the above-referenced document will be transmitted under separate cover.

Should you have questions about this letter please call me at (303) 692-2295 or email me at curtis.stovall@state.co.us.

Sincerely,

Curt Stovall, P.E.
Solid Waste Permitting Unit
Solid Waste and Materials Management Program
Hazardous Materials and Waste Management Division

ec: Joyce Ackerman – EPA Superfund Technical Assessment and Response Team
Mark Adams – Waste Connections
Colleen Brisnehan – CDPHE Site Assessment
Farrell Buller – Town of Erie Deputy Town Administrator
Steve Derus – Republic Services
Lauren Errico – CDPHE Community Involvement
Malcolm Fleming – Town of Erie Town Administrator
David Folkes, PE – Geosyntec Consultants
Ben Frissell – Weld County Department of Public Health and Environment
David Fronczak – EPA Site Assessment Program
Jonathan Gillen, PE – Geosyntec Consultants
Jerry Henderson – CDPHE Solid Waste Permitting Unit Leader
Doug Ikenberry, PE – CDPHE Solid Waste Compliance Assurance Unit
Jason King, Esq – Colorado Office of the Attorney General
Alan Linton – Pratt Management Company, LLC
Amber Luttrell – Town of Erie Communications & Marketing Manager
Randy Perila - CDPHE Solid Waste Compliance Assurance Unit
Ben Pratt, CEcD – Town of Erie Director of Economic Development
Dani Serna, RS/REHS – Weld County Department of Public Health and Environment
Ed Smith – CDPHE Solid Waste Compliance Assurance Unit Leader
Fred Starr, AICP - Town of Erie Director of Planning & Development
Jonathan Steeler, Esq – Senn Visciano Canges P.C.

Pinyon Environmental, Inc.
Corporate Headquarters
3222 South Vance Street, Suite 200, Lakewood, CO 80227
T: 303.980.5200 F: 303.980.0089
www.pinyon-env.com

April 12, 2022

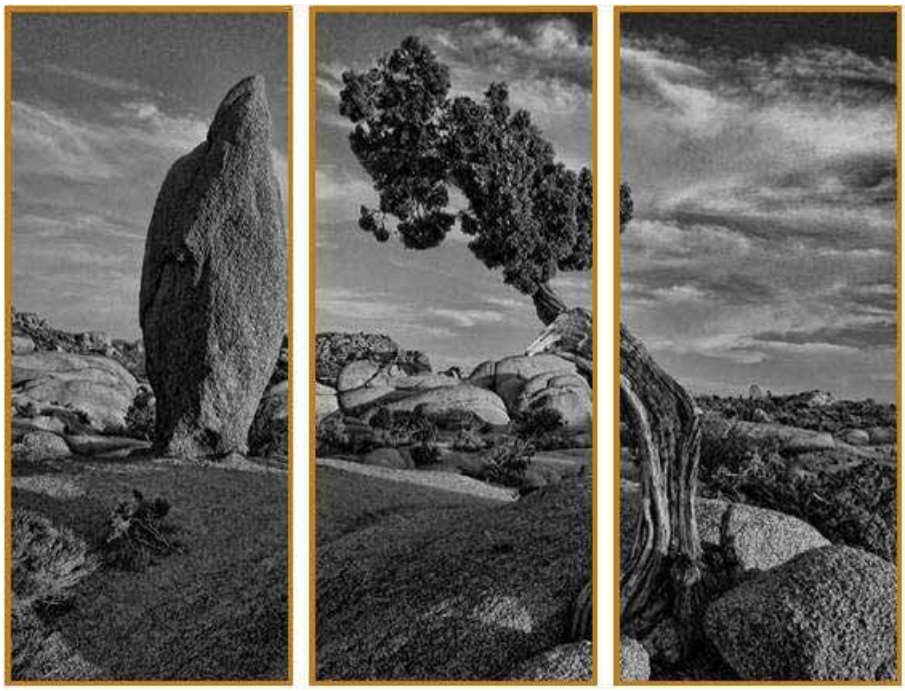
Property Development Environmental Review Update

Stratus Redtail Ranch
Erie, Weld County, Colorado

Prepared For:
Town of Erie
645 Holbrook Street
Erie, CO 80516

Pinyon Project No.:

122069502.SC007



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3222 South Vance Street, Suite 200, Lakewood, CO 80227
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April 12, 2022

Property Development Environmental Review Update

Redtail Ranch
Erie, Colorado

Prepared For:
Town of Erie
645 Holbrook Street
Erie, CO 80516

Pinyon Project No.:

122069502.SC007

Prepared by:

Tim Grenier, P.E.
Technical Group Manager – Due Diligence/Site Characterization

Darin Worden
Senior Hydrologist

Reviewed by:

Brian Partington
Principal – Project Delivery

Table of Contents

Figures

List of Acronyms

Acronym	Definition
AOC	Administrative Settlement Agreement and Order on Consent
bgs	below ground surface
CDPHE	Colorado Department of Public Health and Environment
CGS	Colorado Geological Survey
CGWS	Colorado Groundwater Screening Levels
CMD	Corrective Measure Design
CMWP	Corrective Measures Work Plan
COC	Compounds of Concern
COPC	Contaminants of Potential Concern
CR	County Road
CREC	Controlled Recognized Environmental Condition
DCE	Dichloroethylene
DO	Dissolved Oxygen
EISB	Enhanced In-situ Bioremediation
EM	Electromagnetic
EPA	Environmental Protection Agency
ESA	Environmental Site Assessment
ET	Evapotranspiration
GPR	Ground Penetrating Radar
IBM	International Business Machines
IDW	Investigation Derived Waste
ISCO	In-situ Chemical Oxidation
LEL	Lower Explosive Limit
MCLs	Maximum Contaminant Levels
MNA	Monitored Natura Attenuation
NGPRS	National Ground Penetrating Radar Services
NAD	No Action Determination
ORP	Oxidation Reduction Potential
PA	Preliminary Assessment
PCE	Tetrachloroethylene
PCMM	Post-Closure Monitoring and Maintenance
PID	Photoionization Detector
POC	Point of Compliance
ppm	parts per million
PVC	Polyvinyl Chloride
REC	Recognized Environmental Conditions
RPA	Revised Preliminary Assessment
SEC	Stewart Environmental Consultants
SVOC	Semi-Volatile Organic Compounds
TCE	Trichloroethene
TOC	Total Organic Carbon

TPH	Total Petroleum Hydrocarbon
TT	Tetra Tech
VOC	Volatile Organic Compounds

1. Introduction

The subject property consists of two parcels totaling approximately 418 acres. Parcel 1 is the Stratus Redtail Ranch Property (Weld County Parcel Number 146729400002), which is approximately 290-acres; Parcel 2 is the Stratus Redtail Ranch 2 Property (Weld County Parcel Number 146729200046) which is approximately 128-acres and located to the northwest of Parcel 1. Combined, Parcel 1 and Parcel 2 with be referred to as the Site.

The Site includes the majority of Section 29, Township 1 North, Range 68th of the 6th Principal Meridian (Section 29), and is located to the southwest of Weld County Road (CR) 6 and CR 5. The east-adjacent property is the Front Range Landfill; the south adjacent property is developed with a golf course and residences; the west adjacent properties are residential; and the Denver Regional Landfill and Old Erie Landfill are located adjacent north of the Site (Figure 1). (Note: Pinyon has included figures prepared by others and appended to this report.) Stratus acquired the Site in July 2015 with plans to redevelop the property for residential purposes. Stratus submitted a Corrective Measure Design (CMD) Report to the Colorado Department of Public Health and Environment (CDPHE) in anticipation of development of the property for residential purposes, which CDPHE approved on May 12, 2020. At the request of the Town of Erie (Town), Pinyon reviewed documents available at that time, that were related to the Site. Following the review, Pinyon prepared the *Property Development Environmental Review*, dated March 5, 2020, providing a summary and professional opinions including recommendations on how thorough, complete, and technically sound Stratus' work had been.

Since that time, Stratus has implemented treatment of volatile organic compound (VOC)-impacted groundwater in release source areas through implementation of in-situ chemical oxidation (ISOC). Additionally, Stratus prepared and submitted an application for No Action Determination (NAD) through CDPHE. Several additional documents have been prepared by CDPHE, Geosyntec Consultants (Geosyntec), and the Colorado Geological Survey (CGS).

The Town requested Pinyon complete a second independent third-party analysis of the new/additional environmental documents including work remaining under the CMD to assist the Town's understanding of whether or not the CMD will adequately protect human health and the environment. Additionally, the Town requested that Pinyon's original report, dated November 5, 2020, be updated to include a summary and review of the new/additional documents.

1.1 Methods

Pinyon reviewed the new documents related to the Site, which were provided by the Town. The new information was incorporated into the original report. Therefore, this updated report has been segregated into the following main categories:

- Site background presented in Sections 2.1 and 2.2.
- Site remediation activities completed through November 5, 2020 (Sections 2.3 and 2.4).
- Site remediation and monitoring plans and reports are presented in Section 3 including:
    - Geosyntec's Corrective Measures Design (CMD) (Sections 3.1 – 3.7).
    - Geosyntec's response to Pinyon's Property Development Environmental Review Report, November 5, 2020 (Section 3.8).

- ISOC Implementation Report (Section 3.9).
- Stratus filing of the NAD and the subsequent CDPHE approval (Section 3.10).
- CGS's review of the NAD and multiple other documents including a geotechnical study of the Site and underground coal mine subsidence investigation; and Geosyntec's response to the CGS review (Section 3.11).

- Pinyon's conclusions and recommendations are presented in Section 5.

2. Site History

2.1 Site Background

The north and northeastern portion of Section 29 (Denver Regional Landfill and Old Erie Landfill) as well as the northern and northeastern portion of the Site (Neuhauser Landfill) were historically used for landfilling activities from approximately the mid-1960's through 1969 (Figure 1). Numerous environmental investigations and site assessments have been completed at the Site starting in 1969 when complaints from neighboring property owners led to Weld County holding a hearing regarding Certificate of Designation status for the Neuhauser Landfill. The landfill Certificate of Designation was revoked, and operations were forced to cease in 1969 (Weld County, 1969).

A Preliminary Assessment (PA) and subsequent Revised Preliminary Assessment (RPA) were completed for the Columbine Landfill in 1984 and 1990, respectively. The Columbine Landfill consists of two parcels; one is the approximately 160-acre parcel currently known as the Denver Regional Landfill (adjacent north of the Site), and the second parcel is a 35-acre parcel currently known as the Old Erie Landfill (adjacent to the north of the northeast portion of the Site) (Figure 1). The reports found that John Neuhauser leased property immediately south of the Denver Regional Landfill and the Old Erie Landfill (the northern portion of the Site), circa 1964. John Neuhauser entered into contract agreements with International Business Machines (IBM) and Sundstrand Aviation to dispose of chemical waste at the Neuhauser Landfill (CDPHE, 1984). The PA noted that up to 1,500 drums containing approximately 84,000 gallons of chemical waste from IBM may have been disposed at the Neuhauser Landfill in the 1960's.

2.2 Site Investigations

Numerous environmental investigations have been completed to evaluate impacts stemming from the historical landfill and chemical disposal facility on the northern and northeastern portion of Section 29, including portions of the Site. The following sections focuses on the Site investigation and cleanup activities and does not discuss the history or cleanup activities conducted on the Denver Regional and Old Erie Landfill portions of Section 29.

2.2.1 Tetra Tech – Summary Report of Preliminary Site Investigation Activities, February 2007 (TT, 2007)

Three soil vapor monitoring points were installed on January 11, 2007, along the northeastern Site boundary, south of the Old Erie Landfill (Figure 2 [the red labels, SV-1 (TT), SV-2 (TT), and SV-3 (TT)]); soil vapor samples were collected on January 16, 2007 and were analyzed for landfill gas suites and volatile organic compounds (VOCs) by U.S. Environmental Protection Agency (EPA) Method AP-42. In addition to the soil vapor samples, two groundwater samples were collected from existing wells located south of the Old Erie Landfill on January 15, 2007. Groundwater was observed at depths between 18.50 and 54.62 feet below ground surface (bgs). The groundwater samples were analyzed for total petroleum hydrocarbons (TPH) and VOCs.

Various VOCs exceeded the selected Target Shallow Soil Gas Concentration screening levels in each of the three soil vapor samples. Sample SV-3 (TT), which was collected from the northeastern most corner of the Site had the highest concentrations, with numerous exceedances including trichloroethene (TCE), and tetrachloroethylene (PCE) by factors of 20,000 and 2,000, respectively (Figure 2).

TPH and VOCs were not detected above the laboratory detection limits in the two groundwater samples.

2.2.2 *Stewart Environmental Consultants – Supplemental Soil Vapor Investigation, September 2007 (SEC, 2007)*

Based on the findings of the Tetra Tech soil vapor investigation, Stewart installed an additional 30 soil vapor sampling points throughout the northern and eastern portion of Parcel 1; no vapor points were installed on Parcel 2. The northern points were selected to evaluate soil vapor conditions migrating from the Denver Regional Landfill and Old Erie Landfill properties and the eastern points were used to evaluate potential soil vapor conditions migrating from the east adjacent Front Range Landfill. Most of the points were nested with two screen intervals at five feet, and between 15 to 20 feet bgs. Samples were collected and lab analyzed for VOCs from 16 of the vapor points along the northern portion of Parcel 1 (Figure 2). During this sampling event, TCE was detected above the risk-based screening level at SV-14, SV-16, and SV-22. Samples were not collected for lab analysis at the other vapor point locations; instead, the vapor points were field screened for landfill gases. Those included three locations immediately south of the Old Erie Landfill (SV-10, SV-11, and SV-3(TT)), which indicated methane concentrations above the lower explosive limit (LEL) (Figure 2). Methane was not detected at the other locations.

The investigation concluded that landfill gases were migrating onto the Site from the Denver Regional Landfill and the Old Erie Landfill, but were not migrating onto the Site from the east adjacent Front Range Landfill. The soil vapor impacts were limited to the northern and northeastern portions of the Site, within the Buffer Area. The Buffer Area is an area that is subject to Environmental Use Restrictions to protect future Site users and residents from coming into contact with things that remain at the Site. The Environmental User Restrictions are further discussed in Section 3.2 and shown on Figure 1. Perched groundwater in the northeast corner of the Site was impacted, although the concentrations were not considered an immediate threat to human health.

2.2.3 *Stewart Environmental Consultants – Soil Vapor Monitoring, January 2011 (SEC, 2011)*

This investigation included screening the existing vapor monitoring wells for landfill gases (e.g., methane, carbon dioxide, oxygen, and LEL). No elevated methane or LEL measurements were recorded. Waste Connections, Inc. (the operators of the Denver Regional Landfill), noted that their methane recovery system was improved. This, along with aging of the landfills, was believed to have had a positive effect on the migration of landfill gases into the Site.

2.2.4 *Quality Environmental Services and Technologies, Inc. - Phase I Environmental Site Assessment, March 2015 (Quest, 2015)*

This Phase I Environmental Site Assessment (ESA) was completed as part of Stratus' acquisition of the Site. The Phase I ESA identified surficial soil staining associated with the on-site oil and gas operations. The report identified the east-adjacent Front Range Landfill as a recognized environmental condition (REC) and the north adjacent Denver Regional and Old Erie Landfills as controlled recognized environmental conditions (CRECs).

2.2.5 *Quality Environmental Services and Technologies, Inc. – May 2016 Groundwater Assessment, May 2016 (Quest, 2016)*

Based on the findings of its Phase I ESA, Quality Environmental Services and Technologies, Inc. (Quest), conducted groundwater monitoring at 17 locations, in three phases, at the north/northeast boundary of the Site (Figure 3). Eleven groundwater samples were collected and submitted for lab analysis for VOCs (six of the wells did not produce water). Quest's investigation noted that impacted soils were present along the northeastern portion of the Site. Elevated VOC concentrations exceeding the CDPHE Groundwater Standards

were noted at five locations (GW#3, GW#8, GW#9, GW#13, GW#16, and TB-1), each of which were collected from the northeastern portion of the Site (Figure 3).

2.2.6 Stewart Environmental Consulting Group, LLC – Report on Phase 2 Nature and Extent Investigation, October 2017 (SEC, 2017)

Stewart Environmental Consulting Group, LLC (SEC) installed six shallow (15 to 30 feet) groundwater monitoring wells at the northeastern portion of Parcel 1 (Figures 4a and 4b). SEC collected samples from the newly installed wells and the wells installed by Quest in 2016. Samples were analyzed for VOCs, semi-volatile organic compounds (SVOCs), total organic carbon (TOC), metals, and select organic and inorganic compounds. Multiple exceedances of the Colorado groundwater standards were noted. Groundwater was found to flow from the east to the west and was found to be impacted by multiple VOCs including TCE, toluene, 1,2-dichloroethylene (DCE), and cis-1,2-DCE.

National Ground Penetrating Radar Services (NGPRS) completed ground penetrating radar (GPR) and electro-magnetic (EM) investigations at the Site to identify the locations of the drums identified in the PA and RPA reports completed in 1984 and 1990, respectively, and to identify areas of potential solid waste. Several areas with potential drums were identified during the GPR/EM survey, the locations were confirmed by completing excavations in the discovery areas using a front-end loader. The drum investigation concluded that there were drums buried on the Site; the locations of the drums were mapped; and the total number of drums and their contents were not determined. However, based on sampling of a few drums, some of the drum contents were found to contain hazardous materials.

In conjunction with the drum investigation, SEC also conducted an investigation of buried solid waste at the Site. The investigation methods also included the use of EM techniques and completion of excavated test pits to evaluate anomalies identified during the EM survey. The investigation concluded that there were two solid waste areas at the Site totaling approximately 16-acres (8.5 acres on the east side and 7.5 acres on the west side) (Figure 1). The western solid waste site extends onto the eastern portion of Parcel 2. The solid waste included residential waste, magnetic tape, and drums containing solvents (classified as characteristically hazardous waste).

SEC also completed bedrock mapping during the GPR/EM investigation and found that there is an area of high elevation bedrock on the south side of the Site. It was reported that the bedrock high should prevent shallow groundwater from migrating to the south towards proposed development areas. There was also a bedrock high separating the east and west sides of the Site.

2.2.7 Summary of Site Investigations

Multiple investigations have been completed at the Site, as detailed above. The following are the general findings:

- 1964-1969: The northern portion of the Site was used as a landfill (Neuhauser Landfill) by Sanitation Engineering, Inc., from 1964 to 1969 (the green boundaries presented in Figure 1). Up to 1,500 drums containing approximately 84,000 gallons of chemical waste from IBM may have been disposed at the Neuhauser Landfill in the 1960's. The Neuhauser Landfill extended along the north/northeastern portions of the Site and extended west onto the adjacent Stratus Redtail Ranch 2 Property.

- 2007: Tetra Tech collected three soil vapor samples from the northeastern portion of the Site and found high levels of VOCs migrated from the Denver Regional and Old Erie Landfills. SEC completed additional

soil vapor sampling and found soil vapor and groundwater impacts that were likely from the north adjacent landfills.

- 2011: SEC completed additional landfill gas screening at the Site and no elevated methane or LEL measurements were recorded. This was attributed to an improved methane recovery system at the Denver Regional Landfill, and potentially related to the further aging of the landfill having less material to breakdown and release gases.

- 2015-2017: Stratus acquired the Site in 2015 and Quest completed a Phase I ESA as part of the acquisition. Quest installed 17 groundwater monitoring wells and was able to collect 11 groundwater samples for lab VOC analysis. Elevated VOC concentrations were noted in five samples collected from the northeastern portion of the Site. SEC completed additional groundwater sampling in 2017 and encountered elevated VOCs at the northeastern portion of the Site.

  SEC completed a GPR/EM survey and test trenches to identify the locations of the buried drums and delineated the extent of the solid waste fill areas. They also mapped bedrock and found bedrock highs at the southern portion of the Site and central portion of the Site presumably separating groundwater into an eastern and western regime.

- 2018: CDPHE and Stratus entered into a Compliance Order on Consent (Consent Order) on May 16, 2018, to address remediation and closure of the Neuhauser Landfill site. The following has been completed under the Consent Order:

  - A final report for the drum removal at the Site was submitted to the EPA on August 10, 2018; this is discussed in Section 2.3.

  - Additional Site investigations including test pit excavations to further delineate the extent of solid waste, install shallow groundwater monitoring wells, install a deep groundwater monitoring well, and completed soil borings and sampling of soil from the southern portion of the Site to evaluate suitability to be used for an Evapotranspiration (ET) cover system. Findings of the investigations were included in the Corrective Measures Work Plan (Geosyntec, 2020a) and are detailed in Section 2.4.

2.3 Site Drum and Soil Removal Activities

Stratus and the EPA entered into a voluntary Administrative Settlement Agreement and Order on Consent (AOC) Docket Number CERCLA-08-2018-0002 for removal of the buried drums at the Site (Geosyntec, 2018). Stratus contracted ACTenviro to begin drum removal on December 11, 2017, with the final drums excavated on February 22, 2018. A total of 1,145 drums were excavated, 781 were considered empty, 47 drums contained material that were either removed from or fell out of the drum during excavation, and 317 drums contained materials that were further containerized and sent for disposal. The excavation and drum removal areas were completed as follows (Geosyntec, 2018) (Figures 5a and 5b):

- Phase 1 – Soil excavations occurred between December 2017 and May 2018. Approximately 3,013 cubic yards of soil was excavated from this area. This volume included drums and other wastes, impacted soils, and soils that were deemed suitable for on-site reuse by the EPA based on laboratory analytical results. A total of 1,543.14 tons of soil and materials were transported offsite for disposal; the remaining soil was used as backfill.

- Phase 2A – 444 cubic yards of material was excavated with 144.63 tons found to be impacted and disposed of offsite.

- Phase 2B – 2,643 cubic yards of material was excavated with 1,733.4 tons found to be impacted and disposed of offsite.

- Phase 3 – 1,700 cubic yards of material was excavated with 2,541.04 tons found to be impacted and disposed of offsite.

- An EM survey conducted by NGPRS in December 2017 identified nine additional drums in areas that fell outside of the four area (Phase 1, 2A, 2B, and 3).

- Fourteen drums discovered underneath a road on the Site were excavated; six of the drums contained solid material and the other eight were empty. Soils in the immediate area surrounding these drums did not exhibit contamination based on visual observation and photoionization detector (PID) screening.

- Two full and one partially full 21,000-gallon frac tanks of stormwater, groundwater, and liquids that leaked from drums were characterized and transported offsite for disposal or used for dust suppression when contaminant concentrations were low. The practice of using stormwater and/or groundwater for dust suppression was approved by the EPA and CDPHE.

2.4 Corrective Measures Work Plan (Geosyntec, 2019)

Geosyntec Consultants (Geosyntec) completed a Corrective Measures Work Plan (CMWP) investigation for the Site, which was approved by CDPHE on September 28, 2018. The following were the key objectives of the CMWP investigation:

- CDPHE deemed that previous groundwater sampling completed by Tetra Tech and SEC did not include all of the necessary analytes and requested that additional samples be collected and analyzed for SVOCs (EPA Method 8270), pesticides (EPA Method 8081), herbicides (EPA Method 8151), polychlorinated biphenyls (PCBs) (EPA Method 8082), anions (EPA Method 9056A), and metals (EPA Method 6010B).

- Identify the extent of solid waste on the Site.

- Delineate the nature and extent of shallow groundwater contamination.

- Delineate shallow groundwater migration at the western property boundary with the addition of a westerly well (point of compliance).

- Delineate the nature and extent of contamination in deep groundwater.

- Identify and sample soil for appropriate geotechnical and chemical properties to design and implement final soil cover.

- Obtain additional and supplemental information about the Site to support the evaluation of remedy alternatives and to support the design of a selected remedy.

2.4.1 Test Pit Investigation

A total of 39 test pits were completed from October 3-11, 2018, at the Site; 26 were completed on Parcel 1 and 13 on Parcel 2 (Figures 6a and 6b). Based on the findings of the test pits, Geosyntec was able to map the boundaries of the buried solid waste areas (Figures 6a and 6b). Other anomalies identified during the Site EM survey (Section 2.2.6) were investigated and no additional drums were found. Geosyntec reported that the test pit investigation was successful in delineating the boundaries of the solid waste fill areas and no additional test pits were found to be necessary.

2.4.2 Shallow Groundwater Investigation

A total of 16 groundwater samples were collected from Parcel 1 and one sample from Parcel 2 in November 2018 and analyzed for VOCs, SVOCs, total metals, general chemistry and the CDPHE Appendix II list. Geosyntec reported that the data indicate that horizontal migration of contaminants of potential concern (COPCs) in shallow groundwater was limited, which is consistent with the relatively low permeability of the soil and weathered bedrock at the Site. The impacts are generally concentrated at the northeastern and northcentral portions of the Site. Significant vertical migration through the competent portions of the claystone and sandstone bedrock layers is also not likely, based on the substantial thickness of low permeability claystone and siltstone encountered below the weathered zone; the lack of observed saturation in both the intermediate depth well (MW-24) and deep well (MW-23D); and photoionization detector (PID) readings of less than two parts per million (ppm) in soil and rock cores over the entire depth interval of MW-23D. Therefore, it was concluded that both horizontal and vertical migration of COPCs has been limited and COPC concentrations appear to attenuate rapidly within relatively short distances, as was indicated by the groundwater sampling results shown on Figures 4a and 4b.

2.4.3 Deep Groundwater Investigation

Geosyntec completed an investigation of deep (confined) groundwater in Parcel 1 by installing a two-inch diameter schedule 40 polyvinylchloride (PVC) pipe with 0.010-inch slotted screen to a total depth of at least 216 feet bgs. Coal seams were observed at depths of 68, 71, 168, 192, and 216 feet bgs at well location MW-23D, south of the drum removal areas; however, groundwater was not present and a sample was not collected (Figures 4a and 4b).

3. Corrective Measures

3.1 Corrective Measures Design (Geosyntec, 2020a)

Geosyntec submitted a CMD Report to CDPHE on behalf of Stratus on February 7, 2020, and submitted a revised CMD on May 1, 2020, to address CDPHE comments. CDPHE approved the revised CMD on May 12, 2020. Based on the findings of the previous Site investigations (e.g., shallow groundwater impacts and presence of solid waste) and cleanup activities, the following Site remedies were proposed in the CMD:

- Groundwater remediation via ISCO
- Groundwater remediation via monitored natural attenuation (MNA)
- Solid waste containment via an ET cover system, including stormwater controls
- Post-closure groundwater monitoring
- Post-closure methane gas monitoring
- Long-term monitoring and maintenance of the ET cover and stormwater control features
- Institutional controls

3.2 Groundwater Remediation

3.2.1 In-situ Chemical Oxidation

Geosyntec proposes groundwater remediation via a ISCO system. ISCO is a treatment method usually used to treat soil and groundwater contamination in the source area where contaminants were originally released because the source area may contain contaminants that have yet to dissolve into groundwater. Geosyntec proposes to target the contaminant mass within the weathered bedrock interval below the Phase 2A and 2B excavation area (Figure 7). When oxidants are added to the contaminated soil and groundwater, a chemical reaction occurs that destroys contaminants and produces harmless byproducts (EPA, 2012). ISCO can work relatively quickly to cleanup a source area but the timeline for contaminant cleanup is dependent on how well the oxidants are able to reach the contaminants and how quickly the oxidants are distributed through the groundwater. Oxidants are not harmful to the environment or people and the process poses little risk to the surrounding community. Geosyntec has proposed an enhanced in-situ bioremediation (EISB) system as a contingency to the ISCO; the need of the EISB will be evaluated following the implementation of ISCO.

Based on Pinyon's review of provided documents, a determination for the need of EISB has not yet been reported.

ISCO system performance monitoring will be completed to confirm the effectiveness of the injections and to monitor the contaminant concentrations. Geosyntec has proposed the following performance monitoring program:

- Baseline sampling for Site contaminants of concern (VOCs and 1,4-dioxane)
- Collection of operational data during ISCO injections
- Monitoring of oxidant and the target contaminant concentrations during and for up to 4 weeks (28 days) after injections occur
- Following this, the performance of the groundwater remedy will be evaluated by the post-closure monitoring and maintenance (PCMM) Plan (Section 3.3.6)

ISOC was implemented at the site in October and November 2020. Results are described below in Section 3.9.

3.2.2 Monitored Natural Attenuation

Monitored natural attenuation (MNA) will be used to demonstrate contaminants downgradient of Phases 1 and 3 are attenuating following removal of the drums and impacted soils. It will also be used to confirm contaminants downgradient of Phases 2A and 2B are attenuating, following ISCO. Natural attenuation is a method that relies on natural processes (i.e., biodegradation, sorption, dilution, evaporation, and chemical reactions) to take place to decrease contaminant concentrations. The contaminant concentrations are monitored with regular sampling to evaluate whether the natural processes result in decreases of the contaminant concentrations.

The MNA program would monitor from locations within the groundwater plume near and downgradient from the Phase 2A, 2B, and 3 removal areas, ISCO treatment areas, and at the point of compliance (POC) (Figures 8a and 8b):

- POC well (WCMW-25)
- ISCO performance monitoring wells (MW-16, and MW-21)
- Proximal MNA performance monitoring wells (MW-1, MW-3B, MW-4, MW-5, MW-6, MW-8, MW-11, and MW-12)
- Distal MNA performance monitoring wells (MW-19, MW-22)
- The detection monitoring well (MW-23D)

The MNA sampling locations would be used to evaluate the concentrations of the contaminants over time and will evaluate the geochemical trends to ensure conditions are conducive to successful natural attenuation. The short-term and long-term monitoring plan and frequency are discussed in Section 3.3 and are detailed in the PCMM Plan (Geosyntec, 2020b).

3.2.3 Evapotranspiration Cover System

Geosyntec has proposed a remedy for the solid waste at the Site via an ET cover system. The ET cover system would prevent direct exposure to humans and ecological receptors and would reduce stormwater infiltration and groundwater recharge. The proposed ET cover system would work in conjunction with the groundwater remediation and the stormwater controls to reduce the volume of groundwater and concentrations of contaminants at the Site. Geosyntec designed an ET cover system to:

- Provide final cover for all solid waste within the Cap Extent Area East and Cap Extent Area West boundaries (Figures 9a and 9b)
- Minimize surface water infiltration into the source area
- Maintain existing stormwater flow paths within the Buffer Area
- Utilize soil materials from an adjacent borrow source area located south of the capped areas
- Reduce erosion and provide passive remediation and protection using vegetative growth within the capped areas, which will be covered with a permanent seed mix and erosion control blanket
- Provide additional water balance cover protection in areas where potential future improvements, such as a possible local bike trail system or possible expansion of Weld County Road 5 (CR-5), may encroach on capped areas

Because of the previous Site test pit investigations, the extent of the solid waste has been defined and were incorporated into Geosyntec's ET cover system design. Geosyntec used the CDPHE guidance for water balance covers to design their system with the following considerations:

- Existing groundwater monitoring wells will be maintained and extended to keep the well riser above ground surface; this will allow for future evaluation of the ISCO and MNA programs.
- A noxious weed survey will be completed with noxious weed removal, as needed.
- Prairie dogs and burrowing animals will be removed from the Site prior to construction of the ET cover system.
- Excavations within the solid waste areas will not be completed except for a stormwater drainage channel near CR-5.
- Cover material will be sourced from within the Site, south of the capped areas.
- The system has been calculated to achieve the intended slopes and grades and will meet the minimum soil cover thickness of 2.5 feet, recommended in the CDPHE water balance cover guidance document (CDPHE, 2013).
- The ET cover system design and Use Restrictions (Section 3.2) will accommodate current and future improvements to highway CR-5; however, improvements should be limited to the road right of way.

- The ET cover system design may accommodate bike trail concepts according to the requirements for bike trail design and layout set forth by the Town. If the bike trail is accommodated, details for bike trail crossing ET cover system areas will be incorporated into the design drawings.

- Stormwater diversion channels consisting of compacted cover soil materials with riprap reinforcement will be used to convey water across areas of the ET cover system. The stormwater controls will help in preventing erosion, undermining, scouring, and damage to the ET cover system.

- Areas with a final cover, as well as the buffer area, will be subject to use restrictions including restriction of vehicle traffic except for low ground pressure vehicles.

- Areas with a final cover and areas disturbed during construction will be revegetated using seeding and erosion controls. Vegetation will include native grass species that are effective for managing moisture of the water balance cover soils, minimize infiltration, and protect against stormwater erosion. Trees will not be permitted within the capped areas.

- Soil-gas monitoring probes will be installed and screened to monitor for the presence of explosive gas migration during the post-closure period (Figure 10).

The ET system will be inspected per the Post-Closure Monitoring and Maintenance Plan, discussed in Section 3.4 of this report and included as Appendix I of the CMD report.

3.3 Use Restrictions

The Cap Extent Area East, Cap Extent Area West, and the Buffer Area (together called the Restricted Property) have been defined in the Notice of Environmental Use Restrictions agreement between CDPHE and Stratus (Geosyntec, 2020a). The Cap Extent areas encompass the areas where solid waste has been mapped, the Buffer Area is a minimum offset distance of 100 feet from the Cap Extent areas, or to the Stratus Property boundary, whichever comes first. Some of the use limitations on the Restricted Property include:

- Restrictions to the use of groundwater.

- Unless approved by CDPHE, ground disturbance activities are prohibited.

- Unless approved by CDPHE, irrigation is prohibited.

- Temporary or permanent improvements, earthwork, structures, or appurtenances that increase the flow of stormwater over, through, or under the Buffer Area is prohibited.

- Construction or maintenance of standing water is prohibited.

- Construction of trails for non-motorized vehicles, including electric bikes, are prohibited in the East and West Cap Extent Areas; however, non-motorized vehicle trails are permitted within the Buffer Area. Hard-surface trails are unlikely to create significant increases to infiltration in these areas, particularly if the surface water control system considers these surfaces in its design; therefore, if a hard surface trail system is desired in the use restriction area, this consideration should be communicated with the design team prior to construction.

- Groundwater and surface water use within the Buffer Area is prohibited, excluding the installation, abandonment, or use of monitoring wells.

- Access to the Buffer Area will be restricted with construction fencing until all vegetation has been established per the post-closure monitoring and maintenance plan.

- Utility installation in the Buffer Area may be permitted; however, CDPHE will consult with the Town of Erie prior to approving utilities in the Buffer Area. Utilities would need to be positioned and designed carefully to avoid creating undesirable preferential conduits for groundwater or vapor flow.

- The property owner is responsible for protecting and maintaining the integrity of the remediation systems.

3.4 Proposed Buffer Area

There are many factors that relate to determining a safe setback distance (buffer) for residences at the site. These factors are summarized below and include discussion on possible influences on setback distance.

- The **geologic media** surrounding and underlying the contaminated zones and planned residential development areas at the Site is composed predominantly of 0.5 to 49 feet of unconsolidated clay with sands and silts underlain by approximately 400 ft of consolidated claystone (the Laramie Formation). These unconsolidated and consolidated sediments exhibit relatively low hydraulic conductivity, and consequently, they have restricted the flow of groundwater, transport of dissolved contaminant mass, and migration of contaminant vapor at the Site. This condition tends to favor a reduced setback distance.

- Other conditions, however, can create **secondary permeability** within these sediments that can increase contaminant mass transport. Examples of these conditions include fissures, cracks, fractures, coal seams, and faults; anthropogenic deposits of permeable fill; and utility-lines (e.g., sewer, water, stormwater, communications, and gas) which can act individually, or interconnect, to form preferential flow conduits within the otherwise low-permeability sediments. These conditions tend to favor an increased setback distance.

- Changes in the **distribution of potential energy within the groundwater system** can cause changes in hydraulic gradients, and hence, the direction and/or magnitude of groundwater flow and contaminant mass transfer. While the site documents reviewed show that the potentiometric surface of the shallow groundwater system generally represents favorable groundwater flow gradients—away from the residences and toward the creeks/zones of subsurface contamination—if the water elevation in the creeks increase sufficiently, or the groundwater levels beneath the residences decrease sufficiently, the potentiometric gradients could reverse and cause groundwater, and contaminant mass, to instead flow from the creek/contaminated zones back toward the residences. While this scenario could reduce the concentrations of contaminant mass in the associated significantly increased water flow volume through the creek/drainage, it is also possible that the increased flow volume could mobilize additional contaminant mass. Other activities that could alter groundwater flow patterns at the Site include changes in nearby groundwater well pumping, flood water management practices, area of paved surfaces, ditches and infiltration pond expression, and irrigation practices. The uncertainty of these conditions would tend to favor an increased setback distance.

- Similarly, changes in the distribution of **potential energy within the soil vapor system** can cause contaminant vapor to migrate further or less, and/or in new directions—including through the potential

network of anthropogenic and natural preferential flow conduits described above. Such changes in potential energy in the soil vapor system can be caused by:

- Changes in precipitation, including draught, that influence the movement of wetting fronts through the shallow surface sediments.
- Changes in water table elevations, barometric pressure, ground-surface wind speed, and temperature.
- Chemical reactions that may be occurring in response to ISCO, bioremediation, degradation, interaction, or geochemistry.
- Changes in the distribution of contaminant mass via groundwater advection.

The uncertainty of these conditions would tend to favor an increased setback distance.

- **Capping and Vapor Flow Channeling** can cause vapors that would otherwise migrate upward through the sediments into the atmosphere to instead be trapped beneath clayey surficial soils or an ET cap, for example. These vertically trapped vapors can then migrate laterally below these capping mechanisms, potentially toward residences. Conversely, if the ET cap, along with surface water controls, reduce infiltration and groundwater recharge near/below these areas, groundwater gradients will tend to remain in the favorable direction (away from residences) and the hydraulic potential force (head) available to move contaminant mass down-gradient of the Site will be further diminished. These conditions can favor an increased or reduced setback distance.

Pinyon contacted both Geosyntec and CDPHE to discuss where the 100-foot buffer originated. Pinyon was told that the buffer distance was selected based on guidance provided in the *EPA OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air* (EPA, 2015), the lack of landfill gases measured near the proposed development area, and the age of the landfill (approximately 60 years old).

The variable nature of many of these aforementioned conditions attest to a common difficulty in predicting the fate and transport of contaminant mass, particularly in the vapor-phase, at sites with built structures and utilities located near contaminated areas. On the other hand, numerous residential projects around the country have been successfully built directly on top of landfills—with regulatory approval and the confidence of residents in the long-term protection of health and safety—even when high concentrations of explosive methane are involved. Given that mitigation systems can be engineered to effectively address this condition, the 100-foot buffer at the Redtail site appears reasonable—if appropriate mitigation engineering is implemented.

3.5 Post-Closure Monitoring and Maintenance Plan (Geosyntec, 2020b)

Geosyntec submitted a Post-Closure Monitoring and Maintenance (PCMM) Plan as part of the CMD report. The purpose of the PCMM Plan is to present requirements for inspections, monitoring, and maintenance that will be necessary to preserve the long-term effectiveness of the groundwater remediation systems (the ISCO and MNA programs) and the ET cover system. Those plans, which have been approved by the CDPHE, are presented in the following sections.

3.5.1 Site Security Requirements

Orange construction fencing will be erected around the ET cover area during construction. During the post-closure period, the existing property fencing, and additional split-rail fencing, will be used to surround the ET cover area. There will be signs stating "Keep Out – Environmentally Sensitive Area" every 300 feet along the fence perimeter. Monitoring wells will be fitted with locks and additional security around the Phase 2B ISCO system is proposed to be implemented. The additional security includes locking covers over all open ends of exposed section of PVC piping and maintaining protective fencing around the exposed risers. Routine inspections would be completed as discussed in Section 3.3.5.

3.5.2 Safety Requirements

The PCMM Plan notes that any contractor, subcontractor, consultant or subconsultant working within the boundaries of the Site must do so under their own approved health and safety plan (HASP) which would be specific for the type of work and location it is being completed.

3.5.3 Vector Control Plan

A vector control plan is a plan to limit or eradicate the presence of pests and vectors such as burrowing animals, which pose a threat to the integrity and effectiveness of the ET cover. Burrows dug into the ET cover present a potential problem by providing a preferential pathway for surface water infiltration and increases the likelihood of contaminated materials being brought to the surface during the burrowing process. Geosyntec proposes to remove prairie dogs and other burrowing animals prior to the construction of the ET cover. A survey to identify animals on the Site would be completed prior to the initiation of construction activities and during the routine Site inspections discussed in Section 3.3.5.

3.5.4 Noxious Weed Control

A noxious weed survey of the East and West Cap Extent Areas and the Buffer Zone will be performed prior to initiating Site construction activities and during the routine post-closure period inspections. Noxious weeds will be removed, as needed, and the area of removal will be revegetated per the specifications detailed in the CMD.

3.5.5 Routine Evapotranspiration Cover Inspections

The guidance provided by CDPHE in the *Final Guidance Document – Water Balance Covers in Colorado* would be followed for ongoing maintenance and monitoring practices (CDPHE, 2013). Per the CDPHE guidance document, inspections of the ET cover would occur semi-annually for the first two years after ET cover installation and annually after the first two years. The routine inspections would include:

- The inspections will look for any sign of erosion, burrowing animals, cracks, or failures in the soil on slopes, condition of the vegetation, and any other signs that might be indicative of the ET cover not functioning as intended.

- The inspection will look for signs of surface subsidence, which could indicate settling of solid waste materials, including ponding of water and the presence of tension cracks, slides, or cover soil slumping.

- The presence of pests, vectors, and noxious weeks will be evaluated.

- Vegetation monitoring within the cap area will occur during the routine ET cover inspection. Additionally, a comprehensive assessment of the vegetation will occur annually for the first two years after final cover installation. Following that, the comprehensive inspection will occur on the fifth year after installation and every five years thereafter. Issues regarding vegetation will be remedied or re-seeded within two weeks of identification.

- Stormwater inspections will inspect for:

    - Erosion, undermining, or sloughing of soils on hill sides and channels

    - Signs of erosion or damage to the diversion channels, riprap, and turf reinforcement mats

    - Ponding of water on the ET cover

    - Sediment accumulation in drop structures, spillways, and in areas of channels or ditches that could inhibit water flow

    - Condition of pooled stormwater located upstream and downstream, or between the ET cover areas

3.5.6 Groundwater Monitoring

Groundwater monitoring would be completed to assess the effectiveness of the ISCO and MNA programs, evaluate concentrations at the down-gradient point of compliance (POC) well (WCMW-25 located on Parcel 2), and the effectiveness of the ET cover. Semi-annual groundwater samples will be collected for at least two years following installation of the ISCO system. The samples will be analyzed for 1,4-dioxane and compounds required by the CDPHE Regulations Pertaining to Solid Waste Site and Facilities from the following locations (CDPHE, 2020a) (Figures 8a and 8b):

- POC well (WCMW-25)

- ISCO performance monitoring wells (MW-16, and MW-21)

- Proximal MNA performance monitoring wells (MW-1, MW-3B, MW-4, MW-5, MW-6, MW-8, MW-11, and MW-12)

- Distal MNA performance monitoring wells (MW-19, MW-22)

- The detection monitoring well (MW-23D)

- Additional sampling will be completed at temporary monitoring locations as part of the ISCO system

After at least two years of semi-annual groundwater sampling, annual sampling will be completed for an additional 28 years, for a total of 30 years of groundwater sampling. The reduction from semi-annual to annual sampling must be approved by CDPHE and will be based on the progress of the groundwater remediation. The

following is the anticipated long-term groundwater monitoring program that will be submitted to CDPHE for approval after semi-annual sampling is completed:

- Sampling of the following wells on an annual basis, until the end of the post-closure period:
    - MNA monitoring wells (MW-19, and MW-22)
    - Detection monitoring well (MW-23D)
    - POC monitoring well (WCMW-25)
- Sampling of the following wells on an annual basis for three years, then once every five years until the end of the post-closure period.
    - The proximal MNA monitoring wells (MW-4, MW-8, and MW-12)
    - ISCO monitoring wells (MW-16, and MW-21)
- Decommissioning of all other groundwater wells not listed above
- The soil gas sampling detailed in Sections 3.4.7 and 4, in conjunction with the groundwater monitoring may provide information on the influence that groundwater levels have on vapor transport

3.5.7 Soil Gas Monitoring

Soil gas monitoring is proposed to occur on a quarterly basis following installation of the ET cover. Samples will be collected from the 11 locations presented on Figure 10. Each location will be screened for landfill gases including methane, carbon dioxide, oxygen, and hydrogen sulfide. Depending on the results of the monitoring, the monitoring frequency may be reduced with written approval from CDPHE.

Geosyntec notes that in the event that methane concentrations exceed 100% of the lower explosive limit (LEL), CDPHE, the Town of Erie, and local emergency response authorities will be notified immediately and necessary steps to ensure protection of human health will be taken.

3.5.8 Reporting

A Post Closure Monitoring and Maintenance Report is planned to be submitted to CDPHE semi-annually by February 28 and August 31 for the first two years following Site closure. After the first two year, the report will be submitted annually by February 28, if a reduction in sampling is warranted and approved by CDPHE.

3.6 Stormwater Management

CWC Consultants, Inc. (CWC), developed a stormwater control system for the Site, which has been integrated into the ET cover system. The purpose of the stormwater control system is to protect the functionality of the ET cover system from being compromised by erosion and damage due to stormwater, and to manage stormwater run-on and runoff. Currently, stormwater flows from east to west through the boundary of the

solid waste area and pools in at least four separate locations. The proposed stormwater controls are as follows (Figures 10a and 10b):

- Permanent stormwater diversion structures to control post-closure run-on and runoff.
- Drainage channels, stormwater ponds, and other system controls will accommodate the current drainage area and anticipated drainage from the proposed southern residential development.
- The new stormwater pond will be designed to control discharge to prevent downstream erosion, sedimentation, or impairment of water quality.
- ET cover system integrity would be controlled from erosion and stormwater damage by:
    - Currently there are two existing culverts under CR-5 discharging to the capped areas. A culvert and stormwater diversion channel would be installed to divert water off the capped areas.
- Stormwater conveyance across the Cap Extent Area East and Cap Extent Area West will be by open channel flow; culverts are prohibited below the ET cover soil.
- To manage stormwater migration from the southern portion of the Site (the proposed residential development area), a stormwater diversion ditch has been designed between the cap area and the southern buffer boundary.

3.7 Residential Irrigation Considerations

Excessive irrigation that might occur in the residential areas likely will tend to increase hydraulic head in these areas and enhance the desired gradient for groundwater flow—away from the residential area and toward the contaminated area — and would potentially dilute groundwater impacts. Additionally, the stormwater diversion ditch designed south of the cap areas would convey surface runoff away from the ET system.

3.8 Geosyntec's Response to Pinyon's November 5, 2020 Property Development Environmental Review Report (Geosyntec, 2020c)

In response to Stratus's review of Pinyon's November 5, 2020 report, they requested Geosyntec obtain additional soil vapor information from existing groundwater wells located within the Historical Landfill Area Buffer Zone, and at several additional locations around the Site. Geosyntec collected additional soil vapor data on November 12, 2020, using handheld portable instruments as percent (%) of the total air stream for methane (CH^4), carbon dioxide (CO^2), oxygen (O^2); as well as photoionization detector readings (PID), which were reported in parts per million (ppm).

These data were collected from 11 different locations. Six locations were within the buffer zone, and five were located in other areas of the development. The sampling locations are presented on Figure 11. The sampling method employed readings at five second or 30 second intervals over a five-minute period. Reported results indicated methane readings between 0% and 0.5% by volume. Average PID readings ranged from 0 ppm to 0.45 ppm, with a maximum of 2.3 ppm.

It should be noted that Geosyntec did not provide information on the type/reading wavelength of lamp used in the PID. The lamp is specific to the kind and type of VOC that the PID can identify within acceptable accuracy

ranges. It is Pinyon's experience that most PIDs contain lamps that are specific to gasoline range hydrocarbons and are not accurate for chlorinated hydrocarbons such as TCE and/or PCE. If the PID used by Geosyntec contained the gasoline range hydrocarbon lamp, it is very probable that the VOC measurements, specifically for TCE, PCE, and their degradation products, were grossly underestimated. Therefore, without clarification of the lamp used in the PID, these data are considered unreliable and potentially inaccurate for measuring chlorinated hydrocarbon vapor.

No other responses to issues or recommendations made in Pinyon's November 5, 2020 report were provided in this document.

3.9 Stratus NAD Application (Geosyntec, 2020d) and CDPHE Approval (CDPHE, 2020b)

The Site area that was proposed as the NAD boundary is depicted on Figure 12. This area is outside of the historic landfill, drum burial, and soil/groundwater remediation areas, and includes the proposed residential development.

3.9.1 NAD Application Summary

At the time of issuance of the NAD application, the Site was undeveloped land (zoned as a mix of low-density residential and public lands and institutions) except for unpaved access roads and parking area, metal culverts in ditches, and a stormwater settling pond with a containment berm and rip-rap outfall. The southern portion of the Redtail Ranch 2 property was used for stockpiling borrow soils to use as landfill cover and to manage runoff from the neighboring Denver Regional Landfill. The proposed Site use is for residential development to be incorporated into the Town municipality.

Based on environmental assessment work conducted at the Site, VOCs were not observed in shallow groundwater and only one low-level result for 1,4-dioxane exceeded the Colorado Groundwater Screening Levels (CGWS) along the western Site boundary. Several elevated total metals, dissolved selenium, nitrogen as nitrate+nitrite, and sulfate were also reported in groundwater samples above the CGWS and/or EPA Maximum Contaminant Levels (MCLs) for drinking water. Potable water for the residential development would be provided by the Town and these impacts do not pose a direct risk to humans or the environment. No indications of waste materials or impacts to soils were observed in boreholes and soil samples collected across the Site. Additionally, soil vapor monitoring did not show elevated levels of VOCs or methane migrating from adjoining and nearby off-Site landfills.

Stratus requested that CDPHE approve the NAD application with the intended future land use as a residential development.

3.9.2 NAD Application Contents

The NAD application included the following information:

- General Site information including size, location, and ownership; current land use and zoning; proposed land use and zoning
- Type of contamination

- Site history and adjoining property use
- Basis for the application
- Discussion of the CDPHE's Voluntary Cleanup Roadmap, whereby regulatory oversight and authority of CDPHE's voluntary cleanup program was appropriate for the Site
- A summary of environmental assessments completed at the Site, including:
    - Qualifications of the environmental professionals conducting and overseeing the work
    - Summary and findings from previous environmental reports (all of which have been referenced in previous sections of this document)
    - Physical Site characteristics including topography, geology, and hydrology
- An evaluation of applicable soil, groundwater, and vapor concentration standards
- An evaluation of risks, including potential exposure pathways and mitigation

No remedial action was proposed for the Site. The historic landfill area, which was not part of the NAD application, is undergoing a remedial action effort pursuant to the CMD.

3.9.3 CDPHE Approval

On December 11, 2020, CDPHE issued the No Action Determination Approval for 2259 County Road 5, Erie, CO. The document states that the environmental assessment submitted by the applicant and performed by qualified environmental professionals indicates that there is no evidence of contamination released into the environment present from the applicant's property, which exceeds applicable promulgated state standards, or which poses and unacceptable risk to human health and the environment.

3.10 ISOC Implementation Report (Geosyntec, 2021a)

The report summarizes the ISCO implementation targeting compounds of concern (COC) present in source zone materials and downgradient groundwater in the historic landfilled areas of the Site. The report included objectives, implementation procedures (procurement, drilling, installation, development of performance monitoring points, injections, injection monitoring, and investigation derived waste (IDW)).

3.10.1 ISOC Objectives

ISOC objectives were as follows:

- Target and reduce COC mass in the weathered bedrock
- Reduce the magnitude and distribution of the COC plume over time
- Achieve remediation objectives

The performance of the ISCO remedy in meeting these objectives will be evaluated as part of the post closure monitoring and maintenance reports.

3.10.2 Drilling and Installation of Temporary Monitoring Points

Two temporary monitoring points (PMP-1 and PMP-2) were installed at the downgradient edge of the Phase 2A area, and two additional points (PMP-3 and PMP-4) were installed at the downgradient edge of the Phase 2B area. These monitoring points are shown on Figure 12.

3.10.3 ISOC Injections

Injections were performed October 13 – 16, 2020 (injection #1), and again on November 2 – 5, 2020 (injection #2). Injection solutions included both sodium persulfate and hydrogen peroxide. The chemicals were mixed in separate tanks. Solution concentrations ranged from 97 grams per liter (g/L) to 195 g/L for sodium persulfate; and 12% to 19% for hydrogen peroxide. Solution concentrations were increased due to difficulty in injecting the design amount of injectate.

The injections were made using direct push technology including 2.25-inch Pressure Activated Injection Probes made by Geoprobe Systems®. Injectate surfacing and borehole collapse occurred. Due to an inability to inject the design volume in Phase 2A, injection points were relocated down gradient of the target area. Injection point locations are shown on Figure 12. A total of 10,406 gallons of solution was injected at Phase 2A.

The Phase 2B area used both an injection gallery and direct push injection points. The injection gallery included four two-inch diameter injection wells with bottom screened sections emplaced into a 12-inch thick gravel layer, located at the bottom of the former drum removal/impacted soil excavation area. Injections into the gallery continued until the area became saturated and injectate started surfacing in the southwest corner of the Phase 2B area. Injections in this area were completed, due to the saturation of the injection gallery, into seven direct push points. The injection gallery and direct push point locations are shown on Figure 12. A total of 14,319 gallons of solution was injected into Phase 2B.

3.10.4 Injection Monitoring

Performance monitoring during injections was completed to evaluate:

- Oxidant distribution
- Injection pressures and flow rates
- Heat and gas formation
- Other design or operational parameters that provided indication ISOC reagent distribution

Geochemical parameters were measured in six monitoring wells each day that injections occurred including pre-injection baseline data. The wells included PMP-1 through PMP-4, MW-16, and MW21. Measured parameters included temperature, conductance, pH, dissolved oxygen (DO), and oxidation reduction potential (ORP) using a multi-parameter instrument, and sodium persulfate using a CHEMetrics field test kit. Monitoring frequency was initially at the beginning, middle, and end of each injection day. Monitoring frequency for PMP-1 through MPP-4 was reduced to once per day after positive measures of injection activity were observed.

3.10.5 Distribution of Oxidant During Injection Period

In Phase 2A at the beginning of injections, a significant increase in persulfate, ORP, specific conductance, and DO was observed in PMP-1 and PMP-2, located approximately 10 feet downgradient from the injection area. Additionally, slight increases in persulfate, ORP, and DO were observed in MW-16, located approximately 130 feet from the Phase 2A Area. This large distribution distance suggests that reagent transport was predominantly along discrete fractures within the weathered bedrock and/or more conductive intervals in the weathered bedrock.

In the Phase 2B area, at the beginning of injections into the gallery, a slight increase in ORP and DO was observed in PMP-3 and PMP-4. No increase in persulfate or specific conductance was observed. Because the monitoring points were screened deeper (five to 15 feet bgs) when compared to the injection points (four feet bgs), these data suggest only limited infiltration of injected oxidants into the deeper weathered bedrock occurred. However, after beginning the injections through the direct push points, significant increases in persulfate, ORP, specific conductance, and DO were observed. This suggests that the direct push points were more effective in distributing the reagents into the weathered bedrock.

3.10.6 Heat and Gas Formation

Groundwater temperatures during and immediately following ISCO injections fluctuated approximately 2°C, but no substantial heat or gas generation was observed. This data indicates that the potential for high heat generation due to vigorous reactions is not a concern at this Site.

It is Pinyon's opinion that the lack of heat and gas formation may be a result of only minimal chemical oxidation reactions, i.e., poor treatment and ineffective COC mass reduction. It has been Pinyon's experience that effective ISOC treatments include strong exothermic chemical reactions, generating both off-gassing and heat. Long-term monitoring data review would be required to determine overall COC mass reductions and the overall effectiveness of the ISOC treatment.

3.11 CGS Review of NAD and Other Documents (CGS, 2021) with Geosyntec's Response (Geosyntec, 2021b)

The CGS reviewed the Redtail Ranch – Preliminary Plat PP-001230-2021 and issued a letter report to the Town dated June 25, 2021. This review included eight separate documents and a Site visit conducted on June 24, 2021. Below is a summary of the review findings:

- CGS recommended the following:
    - Delaying development until after the groundwater remediation and two years (at a minimum) of post-remediation groundwater monitoring is complete.
    - Additional long-term monitoring wells (with a long-term monitoring program) between the on-Site landfill sections and the proposed development.
    - The Town require vapor barriers beneath floor slabs and surrounding all below-grade walls to reduce the risk of contaminant infiltration and poor indoor air quality.

- Further evaluate the presence of faults in the Laramie Formation using a comparative analysis because of dry monitoring wells. This analysis would evaluate why some wells contain groundwater and other nearby wells do not, and if faulting is the cause, then the fault(s) could influence contaminated groundwater migration pathways.

- During the Site visit, CGS observed strong rotting garbage odors from one or both of the nearby active landfills, whereby concerns over future odor complaints by residences were raised.

- The relative 100-foot setback distance between the landfilled solid waste and the nearest proposed residential home appeared to be inadequate, considering the residual groundwater impacts.

- The 350-foot setback distance for the on-Site oil and gas activities may not be adequate and should be increased the 500 feet as is required when placing new oil and gas facilities near existing homes. Additionally, a conservative setback from existing pipelines near CR5 was also recommended for the residences in that area.

- Due to the Site being undermined by the Columbine Coal Mine and the risk of associated subsidence, structure and utility design constraints should include limiting allowable foundation length to 115 feet, and utility design to withstand up to 0.17% strain. Lastly, due to the risk of unmapped shafts or other mining-related features existing within the proposed development areas, all grading activities should be carefully observed to identify any unmapped shafts or other mining features.

- Geosyntec's responses included:

  - The basis for the NAD approval is the Voluntary Cleanup Program (VCUP) NAD Application, which was not listed as one of the documents CGS reviewed. Additionally, ISCO injections were completed in October and November 2020 and documented in the In-Situ Chemical Oxidation Implementation Report. Information contained in these reports was the basis for CDPHE approving the NAD application and subsequently issuing the No Action Determination Approval dated December 11, 2020. Based on two phases of investigation by SEC, additional investigations by Geosyntec, four semi-annual monitoring events, and three ISOC performance monitoring events, groundwater contamination is confined to shallow groundwater within the drainage known as the South Draw on the Redtail Ranch property and was not migrating toward the planned residential areas. The removal of drums and contaminated soil, followed by ISOC treatment, has substantially reduced the contaminant mass in the source zone and should reduce both the plume extent and concentrations over time. Groundwater monitoring will continue for the next 30 years. The recommended two years of monitoring after ISOC treatment before development occurs in inconsistent with CDPHE requirements.

  - The intent of the CDPHE-approved CMD is to treat contaminated soils remaining in the drum removal area and not treat the downgradient plume, which is already naturally attenuating prior to treatment of the source zone and is expected to attenuate more rapidly after treatment. ISOC injections were targeted in areas consistent with the CDPHE-approved CMD.

  - Groundwater flow within the weathered bedrock generally follows the bedrock morphology, i.e., it flows toward the west within the draw, which acts as a hydraulic sink for the entire landfill rea. As a result, the groundwater plume is located within the area that will be designated as open space and protected by an environmental covenant. This concept is based on several years of investigation under CDPHE oversight. Information related to this investigation is among the documents contained in the NAD Application.

- The risk of vapor intrusion outside of the landfill/open space portion of the site was evaluated as part of the CMD process. Consistent with EPA (2015) and CDPHE (2021) vapor intrusion guidance, and as approved by CDPHE as part of the CMD, a 100-foot buffer zone was established beyond the extent of the landfill and contaminated groundwater to protect against the potential for lateral diffusion of VOCs. Therefore, the potential for vapor intrusion of the residential development is negligible; nevertheless, soil vapor monitoring will be conducted in the buffer zone to confirm this under the CDPHE-approved CMD.

- Of the 23 active monitoring wells at the site, only four were dry in November 2018. The vertical extent of groundwater impacts, the reason for occasional dry wells in some locations, and the potential influence of shallow faults were all matters of concern to CDPHE. The vertical extent and potential for migration of contamination was addressed to the satisfaction of CDPHE, as indicated by its approvals of the CMD, which includes monitoring over the next 30 years to confirm understanding of site conditions.

- Shallow groundwater is not continuous across the Site and is only found in drainages where stormwater collects and saturates the alluvium and shallow weathered bedrock within the drainage. No hydrological or contaminant data indicate that any faults in this setting have enhanced potential for contaminant migration.

- The 100-foot setback or buffer zone is consistent with both EPA and CDPHE guidance. The remaining issues raised pertain to odors for adjacent landfills, setback distances from oil and gas facilities, and unmapped mine shafts or other geotechnical issues, which are beyond the scope of the approved CMD.

4. Landfill Development Considerations

As indicated earlier, many residential projects have been built directly on/above historical landfills around the country that involve mitigation engineering that protects against the explosion potential associated with methane, and health effects associated with other contaminant vapors. This mitigation engineering can include a range of flow control and monitoring techniques that are specific to the conditions, construction, and uses planned for the Site. Examples of potential concepts that may be worth considering include:

- Positioning and engineering utility corridors to test for, intercept, ventilate, and impede or reverse flow gradients of contaminant vapor away from the residential areas—in addition to conveying resources and/or wastes. This concept could use the gravel filter that typically surrounds these closed system-lines to provide this effect/benefit.

- Using sub-slab radon type mitigation systems in structures to also serve as a second line of protection for potential contaminant vapors.

- Completing regular testing of the vapor in these systems, and in conjunction with monitoring well sampling, as appropriate to characterize and facilitate control of the system.

Soil vapor sampling, prior to initiating development of the residential structure, would provide insight on soil vapor contaminant of concern (COC) concentrations relative to changes in barometric pressure, windspeed, groundwater table elevations, precipitation events (including timing and intensity), and, when corresponding groundwater sampling is taking place, the potentiometric surface of the shallow groundwater system and the concentrations of dissolved COCs. This information will provide an understanding of baseline conditions that can be compared to conditions associated with construction of the ET cover, surface water controls, foundation/slab emplacement, utility line installation, and structure construction.

The information from this sampling would be used to reduce uncertainty and risk of potential vapor transport and exposure "surprises," and inform the team of design considerations for monitoring; potential interceptor, control, and/or ventilation systems; and/or combinations thereof that may be able to be synergistically combined to lower costs while enhancing the protection, and confidence, of residents and stakeholders at the Site. Pinyon can work with the State and Developer's Consultant to flush out the details of this monitoring, while protecting and advancing the Town's interests.

Soil vapor sampling should also be completed under floor slabs as they are being constructed to monitor for potential slab-effects which can include concentrating soil vapors. This sampling should be continued as the structures are completed above the slabs to measure the effects of the increased upward pressure gradient that is caused by the enclosed structure. This sampling can be completed on a representative basis for each residential area and would likely focus on the residential structures located closest to the creeks.

5. Conclusions and Recommendations

Pinyon has reviewed numerous reports summarizing the Site's history, site characterization, cleanup activities, and corrective measure plan, as detailed in the previous sections of this report. The Site has an extensive history of impacts associated with both on and off-site landfill operations. Over 1,100 buried IBM chemical drums and an area of approximately 16 acres of solid waste was buried at the Site. The drums and grossly contaminated soils around the drums have been excavated and removed from the Site. Other solid waste and impacted groundwater and potentially impacted soil gas remain on the Site. Groundwater at the Site generally flows from east to west with bedrock high points on the southern and central portions of the Site that restricts the flow.

Geosyntec has submitted, and CDPHE has approved, a CMD which details the approaches that will be taken to remediate impacted soil and groundwater and prevent the buried solid waste from further negatively impacting human health and the environment (Geosyntec, 2020a). The impact source areas (i.e., the areas where the drums were buried) will be remediated using an ISCO system and MNA, and the solid waste will be capped with an ET cover. Groundwater and soil gas monitoring are proposed to be completed for no less than a 30-year period. The monitoring and inspection requirements were summarized above.

With such an extensive history of environmental issues at the Site, it cannot be guaranteed that mitigation measures will be protective of human health and the environment. However, it is Pinyon's opinion that although the solid waste will remain on Site, if properly implemented, the CMD adequately addresses and mitigates potential concerns associated with future residential development that would occur outside the buffer area. The main source of impacts at the Site were removed during the drum and impacted soil excavations. The proposed ISCO and MNA remediation programs, the capping of the solid waste areas, the proposed buffer area and use restrictions, the stormwater design plan, and the short and long-term soil gas and groundwater monitoring, should address the environmental and human health concerns associated with the former Site uses.

Pinyon recommends the following:

- At least one additional soil gas monitoring point should be installed to the west of the Cap Extent Area West, approximately 350 feet south of WCMW-25.

- Construction activities should be completed with a CDPHE approved Materials Management Plan (MMP) with the oversight of an environmental professional (MMP Supervisor) skilled in the identification and management of solid and/or hazardous wastes. The MMP supervisor should be 40-Hour Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations Trained with and current 8-hour OSHA annual update. Any suspect materials discovered during work should be immediately reported to the CDPHE. Should suspect environmental issues be identified in other areas of the development, it may be necessary to amend the CMD should other impacts be identified during the development of the property.

- Contractors doing work construction supporting development of the property should be educated on the environmental constraints at portions of the Site and be provided instructions to report suspect discoveries that may occur during the work.

- To support mitigation engineering at the Redtail site, Pinyon recommends that soil vapor be sampled at the wells scheduled for post-closure soil gas sampling—beginning early enough to inform the design process. The wells that should be part of this vapor sampling are those located between the creeks and

the planned residential areas, particularly near the areas with remaining contamination (northeast corner of the Site). We assume that these wells have screens that extend above the top of the water table at the time of sampling. Lastly, the soil vapor sampling should include appropriate hand-held instrumentation best suited to accurately measure PCE/TCE and their degradation products in air, or laboratory analysis, such that these data can be relied on to evaluate and understand site conditions.

- Sub-slab radon type ventilation systems are recommended for all structures at the Site. The systems should be designed for coverage below all subgrade walls and floors. The systems can include concealed piping stubs that if landfill gas or vapor intrusion issues arise, the stubs can be accessed and blowers connected to provide appropriate protections for the residences.

- Each proposed residential structure should be constructed with a sub-slab vapor mitigation system to vent potential landfill gases and VOCs. These are often similar (or the same) in construction techniques as a radon venting system. Those systems should be designed to operate both passively, and if concerns are identified later, to be easily retrofitted to operate actively (i.e., with a blower, ideally explosion proof [intrinsically safe]). It may be beneficial to engage an environmental engineer during the structure design to incorporate a venting system, as retrofitting a venting system is more costly than incorporating into the original construction. Further, the environmental engineer should verify proper construction of the systems during and after construction to ensure proper function. Post-construction sampling in the system for the presence of landfill gases and VOCs should be considered, which can be the deciding factor on whether the system should operate passively or actively. This screening can likely be completed with field screening devises such as a PID and a four-gas landfill meter.

- The PCMM Report will be submitted to CDPHE. If the Town desires, it should be requested that copies of the report also be submitted to the Town for review.

- The post-closure soil gas monitoring plan states that if methane concentrations exceeding 100% of the LEL are detected, CDPHE, the Town of Erie, and local emergency response authorities will be notified. It would be recommended that the CDPHE and Town of Erie be notified if 10 of LEL is detected, this way the issues can be addressed before becoming an explosion hazard.

- Pinyon was not provided groundwater or reliable soil gas data for the areas of Parcel 2 that share a boundary with the Denver Regional Landfill; therefore, Pinyon cannot provide recommendations on the Parcel 2 design.

- For the ET cover system, in addition to inspections during the regularly scheduled intervals, the area should be inspected after substantial rain events until vegetation has taken hold. Rules regarding stormwater permits should be followed for this work.

- If underground utilities related to the current and historical oil and gas operations have not been mapped or searched, an investigation should be completed.

6. Limitations

This Environmental Site Evaluation was prepared by Pinyon Environmental, Inc., at the request of and for the sole benefit of the Town of Erie, or any entity controlling, controlled by, or under common control with the Town of Erie. The conclusions and recommendations offered in this report are based on the data collected and presented by other consultants. Pinyon cannot warrant the sampling methods, or the quality of the data provided and cannot be held liable for errors, omissions, or negligence (if applicable) for the work of others in any way. Our work is based on the review of the work of others, and we cannot validate their work.

This report is for the exclusive and present use of the Town of Erie, or any entity controlling, controlled by, or under common control with the Town of Erie. Laboratory analysis performed during the previous investigations were completed for specific constituents, as described in the text. This study makes no attempt to assess constituents not searched for in the previous investigations.

7. References

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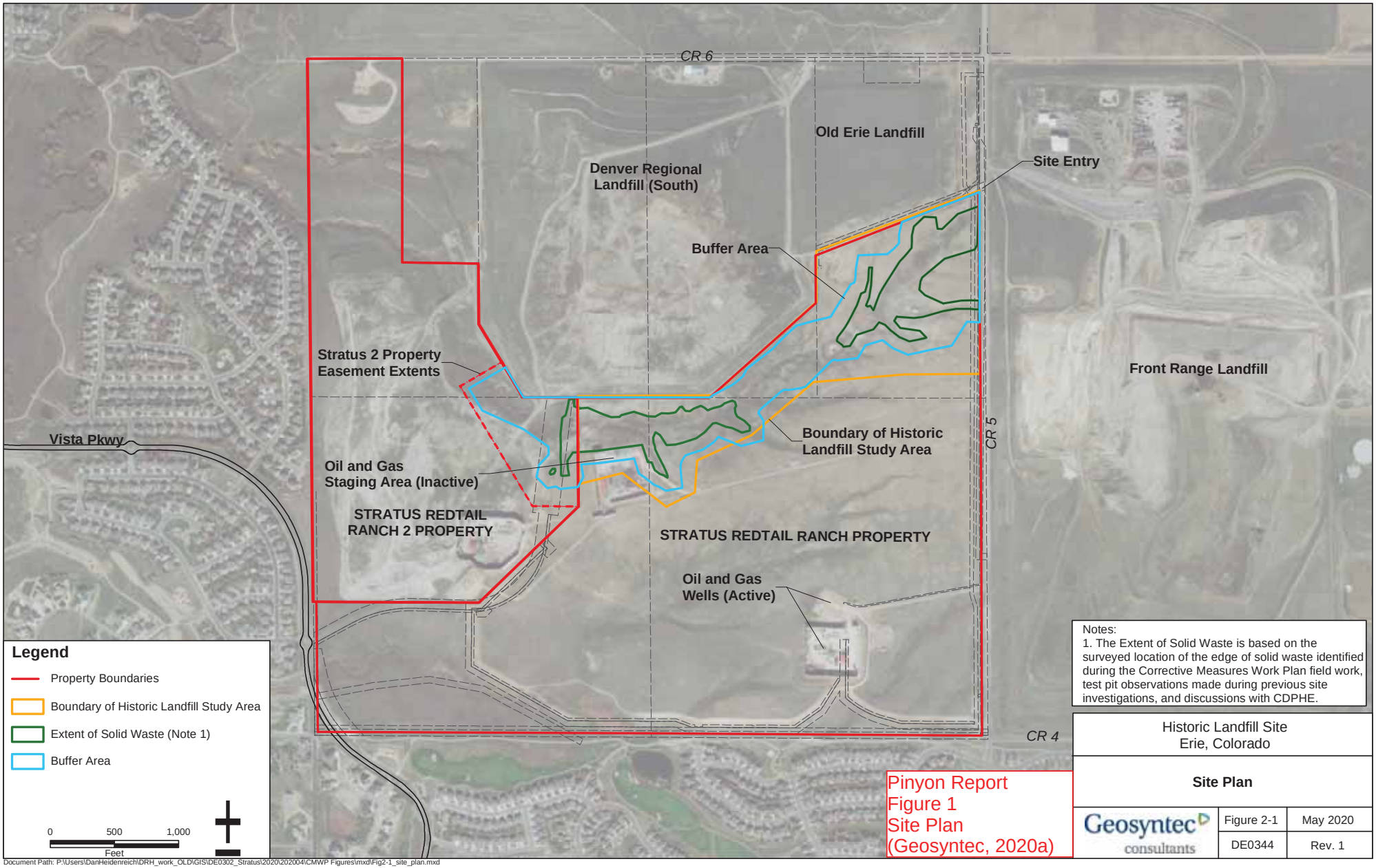
Figures


CR 6
Old Erie Landfill
Denver Regional Landfill (South)
Site Entry
Buffer Area
Stratus 2 Property Easement Extents
Front Range Landfill
Vista Pkwy
Boundary of Historic Landfill Study Area
CR 5
Oil and Gas Staging Area (Inactive)
STRATUS REDTAIL RANCH 2 PROPERTY
STRATUS REDTAIL RANCH PROPERTY
Oil and Gas Wells (Active)
CR 4
Legend
Property Boundaries
Boundary of Historic Landfill Study Area
Extent of Solid Waste (Note 1)
Buffer Area
0
500
1,000
Feet
Notes:
1. The Extent of Solid Waste is based on the surveyed location of the edge of solid waste identified during the Corrective Measures Work Plan field work, test pit observations made during previous site investigations, and discussions with CDPHE.
Historic Landfill Site
Erie, Colorado
Site Plan
Geosyntec consultants
Figure 2-1
May 2020
DE0344
Rev. 1
Pinyon Report
Figure 1
Site Plan
(Geosyntec, 2020a)
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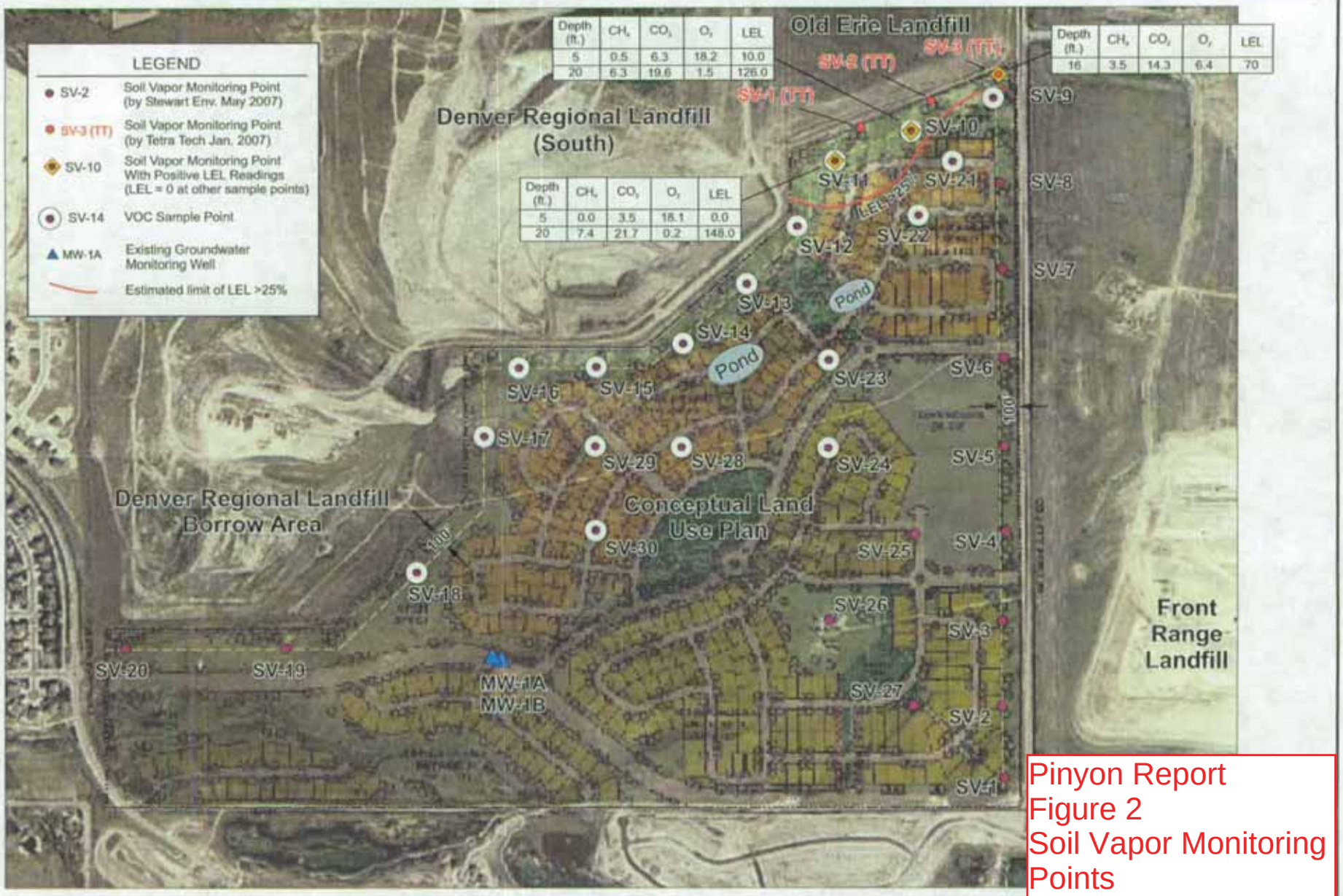
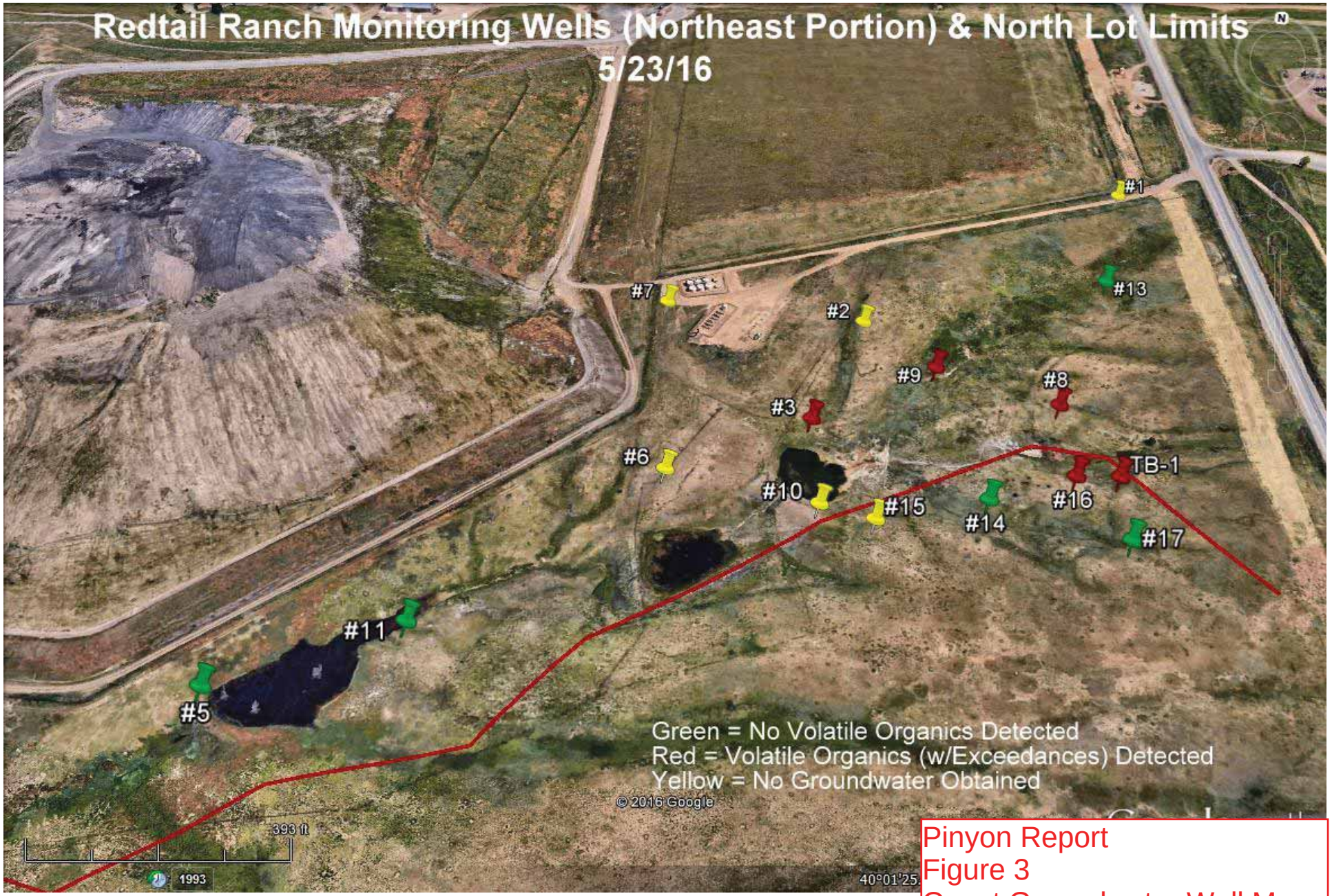


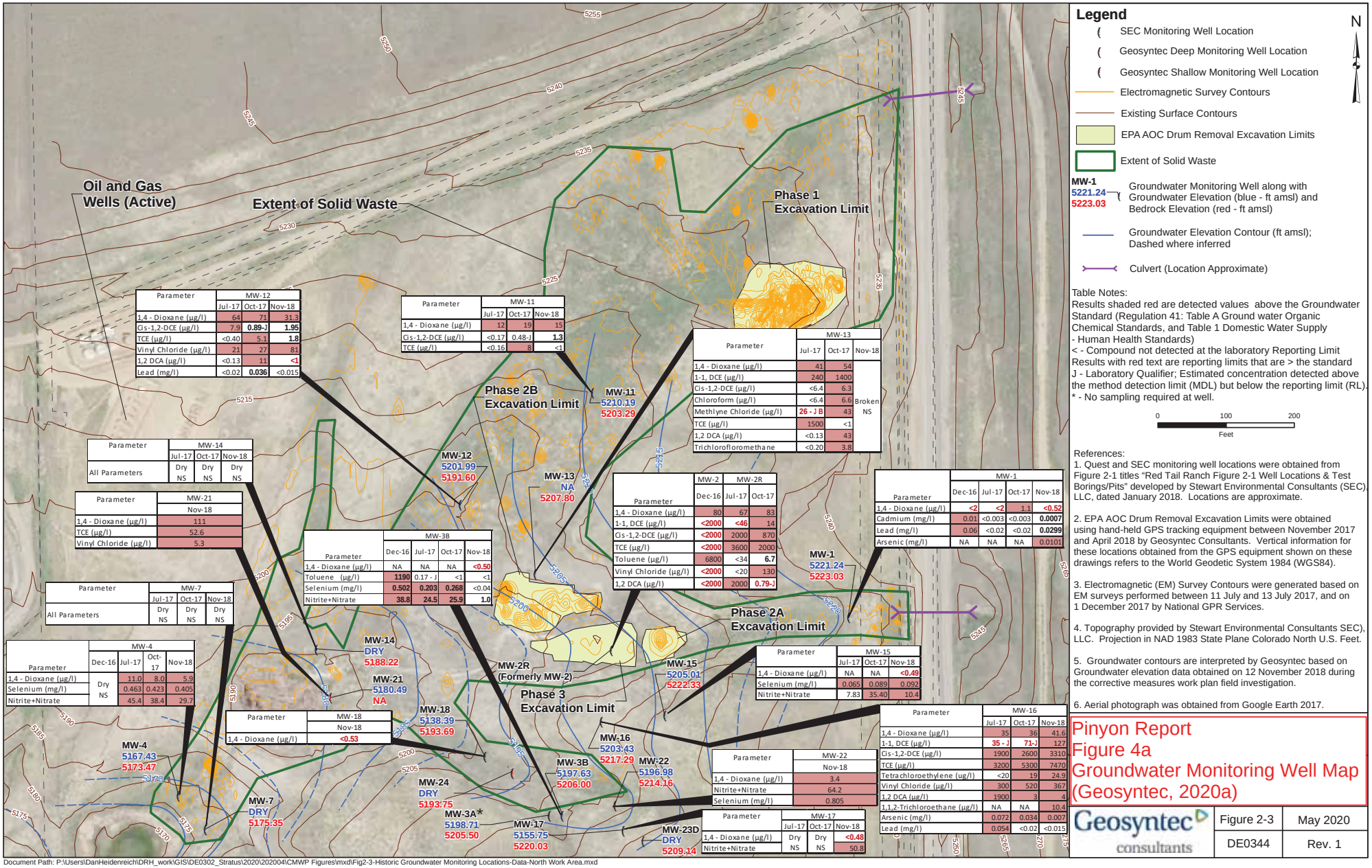
Pinyon Report
Figure 2
Soil Vapor Monitoring Points
(SEC, 2011)

Stewart Environmental Consultants, Inc. *consulting engineers and scientists*	PROJECT NUMBER 3710-001 DATE August 2007	PROJECT Old Erie Landfill Erie, Colorado	FIGURE 2 SOIL VAPOR MONITORING SUMMARY OF RESULTS

Engneer\3700\3710-001\Old erie lf sample results lel and voc.cdr



Pinyon Report
Figure 3
Quest Groundwater Well Map
(Quest, 2016)



Parameter	MW-12		
	Jul-17	Oct-17	Nov-18
1,4 - Dioxane (µg/l)	64	71	31.3
Cis-1,2-DCE (µg/l)	7.9	0.89-J	1.95
TCE (µg/l)	<0.40	5.1	1.8
Vinyl Chloride (µg/l)	21	27	81
1,2 DCA (µg/l)	<0.13	11	<1
Lead (mg/l)	<0.02	0.036	<0.015

Parameter	MW-11		
	Jul-17	Oct-17	Nov-18
1,4 - Dioxane (µg/l)	12	19	15
Cis-1,2-DCE (µg/l)	<0.17	0.48-J	1.3
TCE (µg/l)	<0.16	8	<1

Parameter	MW-13		
	Jul-17	Oct-17	Nov-18
1,4 - Dioxane (µg/l)	41	54	Broken NS
1-1, DCE (µg/l)	240	1400	
Cis-1,2-DCE (µg/l)	<6.4	6.3	
Chloroform (µg/l)	<6.4	6.6	
Methlyne Chloride (µg/l)	26 - J B	43	
TCE (µg/l)	1500	<1	
1,2 DCA (µg/l)	<0.13	43	
Trichlorofloromethane	<0.20	3.8	

Parameter	MW-14		
	Jul-17	Oct-17	Nov-18
All Parameters	Dry NS	Dry NS	Dry NS

Parameter	MW-21
	Nov-18
1,4 - Dioxane (µg/l)	111
TCE (µg/l)	52.6
Vinyl Chloride (µg/l)	5.3

Parameter	MW-3B			
	Dec-16	Jul-17	Oct-17	Nov-18
1,4 - Dioxane (µg/l)	NA	NA	NA	<0.50
Toluene (µg/l)	1190	0.17 - J	<1	<1
Selenium (mg/l)	0.502	0.203	0.268	<0.04
Nitrite+Nitrate	38.8	24.5	25.9	1.0

Parameter	MW-2	MW-2R	
	Dec-16	Jul-17	Oct-17
1,4 - Dioxane (µg/l)	80	67	83
1-1, DCE (µg/l)	<2000	<46	14
Cis-1,2-DCE (µg/l)	<2000	2000	870
TCE (µg/l)	<2000	3600	2000
Toluene (µg/l)	6800	<34	6.7
Vinyl Chloride (µg/l)	<2000	<20	130
1,2 DCA (µg/l)	<2000	2000	0.79-J

Parameter	MW-1			
	Dec-16	Jul-17	Oct-17	Nov-18
1,4 - Dioxane (µg/l)	<2	<2	1.1	<0.52
Cadmium (mg/l)	0.01	<0.003	<0.003	0.0007
Lead (mg/l)	0.06	<0.02	<0.02	0.0299
Arsenic (mg/l)	NA	NA	NA	0.0101

Parameter	MW-7		
	Jul-17	Oct-17	Nov-18
All Parameters	Dry NS	Dry NS	Dry NS

Parameter	MW-4			
	Dec-16	Jul-17	Oct-17	Nov-18
1,4 - Dioxane (µg/l)	Dry NS	11.0	8.0	5.9
Selenium (mg/l)		0.463	0.423	0.405
Nitrite+Nitrate		45.4	38.4	29.7

Parameter	MW-18
	Nov-18
1,4 - Dioxane (µg/l)	<0.53

Parameter	MW-15		
	Jul-17	Oct-17	Nov-18
1,4 - Dioxane (µg/l)	NA	NA	<0.49
Selenium (mg/l)	0.065	0.089	0.092
Nitrite+Nitrate	7.83	35.40	10.4

Parameter	MW-16		
	Jul-17	Oct-17	Nov-18
1,4 - Dioxane (µg/l)	35	36	41.6
1-1, DCE (µg/l)	35 - J	71-J	127
Cis-1,2-DCE (µg/l)	1900	2600	3310
TCE (µg/l)	3200	5300	7470
Tetrachloroethylene (ug/l)	<20	19	24.9
Vinyl Chloride (µg/l)	300	520	367
1,2 DCA (µg/l)	1900	3	4
1,1,2-Trichloroethane (µg/l)	NA	NA	10.4
Arsenic (mg/l)	0.072	0.034	0.007
Lead (mg/l)	0.054	<0.02	<0.015

Parameter	MW-22
	Nov-18
1,4 - Dioxane (µg/l)	3.4
Nitrite+Nitrate	64.2
Selenium (mg/l)	0.805

Parameter	MW-17		
	Jul-17	Oct-17	Nov-18
1,4 - Dioxane (µg/l)	Dry NS	Dry NS	<0.48
Nitrite+Nitrate			50.8

Legend

- SEC Monitoring Well Location
- Geosyntec Deep Monitoring Well Location
- Geosyntec Shallow Monitoring Well Location
- Electromagnetic Survey Contours
- Existing Surface Contours
- EPA AOC Drum Removal Excavation Limits
- Extent of Solid Waste
- MW-1 5221.24 5223.03 — Groundwater Monitoring Well along with Groundwater Elevation (blue - ft amsl) and Bedrock Elevation (red - ft amsl)
- Groundwater Elevation Contour (ft amsl); Dashed where inferred
- Culvert (Location Approximate)

N

Table Notes:
Results shaded red are detected values above the Groundwater Standard (Regulation 41: Table A Ground water Organic Chemical Standards, and Table 1 Domestic Water Supply - Human Health Standards)
< - Compound not detected at the laboratory Reporting Limit
Results with red text are reporting limits that are > the standard
J - Laboratory Qualifier; Estimated concentration detected above the method detection limit (MDL) but below the reporting limit (RL).
* - No sampling required at well.

0 100 200
Feet

References:
1. Quest and SEC monitoring well locations were obtained from Figure 2-1 titles "Red Tail Ranch Figure 2-1 Well Locations & Test Borings/Pits" developed by Stewart Environmental Consultants (SEC), LLC, dated January 2018. Locations are approximate.

2. EPA AOC Drum Removal Excavation Limits were obtained using hand-held GPS tracking equipment between November 2017 and April 2018 by Geosyntec Consultants. Vertical information for these locations obtained from the GPS equipment shown on these drawings refers to the World Geodetic System 1984 (WGS84).

3. Electromagnetic (EM) Survey Contours were generated based on EM surveys performed between 11 July and 13 July 2017, and on 1 December 2017 by National GPR Services.

4. Topography provided by Stewart Environmental Consultants SEC), LLC. Projection in NAD 1983 State Plane Colorado North U.S. Feet.

5. Groundwater contours are interpreted by Geosyntec based on Groundwater elevation data obtained on 12 November 2018 during the corrective measures work plan field investigation.

6. Aerial photograph was obtained from Google Earth 2017.

Pinyon Report
Figure 4a
Groundwater Monitoring Well Map (Geosyntec, 2020a)

Geosyntec consultants

Figure 2-3	May 2020
DE0344	Rev. 1

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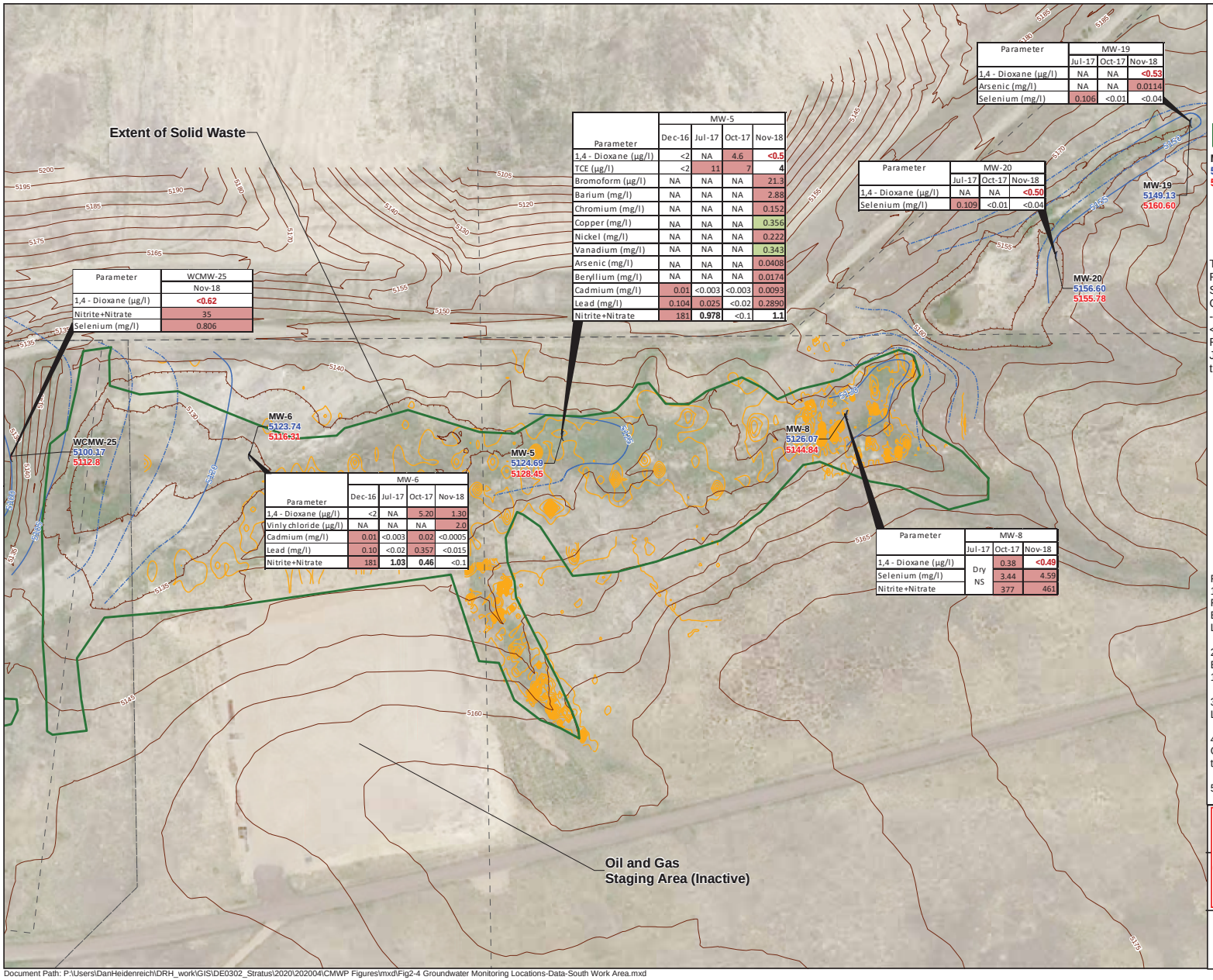

Parameter	WCMW-25
	Nov-18
1,4 - Dioxane (µg/l)	<0.62
Nitrite+Nitrate	35
Selenium (mg/l)	0.806

Parameter	MW-5			
	Dec-16	Jul-17	Oct-17	Nov-18
1,4 - Dioxane (µg/l)	<2	NA	4.6	<0.5
TCE (µg/l)	<2	11	7	4
Bromoform (µg/l)	NA	NA	NA	21.3
Barium (mg/l)	NA	NA	NA	2.88
Chromium (mg/l)	NA	NA	NA	0.152
Copper (mg/l)	NA	NA	NA	0.356
Nickel (mg/l)	NA	NA	NA	0.222
Vanadium (mg/l)	NA	NA	NA	0.343
Arsenic (mg/l)	NA	NA	NA	0.0408
Beryllium (mg/l)	NA	NA	NA	0.0174
Cadmium (mg/l)	0.01	<0.003	<0.003	0.0093
Lead (mg/l)	0.104	0.025	<0.02	0.2890
Nitrite+Nitrate	181	0.978	<0.1	1.1

Parameter	MW-6			
	Dec-16	Jul-17	Oct-17	Nov-18
1,4 - Dioxane (µg/l)	<2	NA	5.20	1.30
Vinly chloride (µg/l)	NA	NA	NA	2.0
Cadmium (mg/l)	0.01	<0.003	0.02	<0.0005
Lead (mg/l)	0.10	<0.02	0.357	<0.015
Nitrite+Nitrate	181	1.03	0.46	<0.1

Parameter	MW-19		
	Jul-17	Oct-17	Nov-18
1,4 - Dioxane (µg/l)	NA	NA	<0.53
Arsenic (mg/l)	NA	NA	0.0114
Selenium (mg/l)	0.106	<0.01	<0.04

Parameter	MW-20		
	Jul-17	Oct-17	Nov-18
1,4 - Dioxane (µg/l)	NA	NA	<0.50
Selenium (mg/l)	0.109	<0.01	<0.04

Parameter	MW-8		
	Jul-17	Oct-17	Nov-18
1,4 - Dioxane (µg/l)	Dry NS	0.38	<0.49
Selenium (mg/l)		3.44	4.59
Nitrite+Nitrate		377	461

Legend

- SEC Monitoring Well Location
- Geosyntec Shallow Monitoring Well Location
- Electromagnetic Survey Contours
- Existing Surface Contours
- Extent of Solid Waste
- MW-19 / 5149.13 / 5160.60 — Groundwater Monitoring Well along with Groundwater Elevation (blue - ft amsl) and Bedrock Elevation (red - ft amsl)
- Groundwater Elevation Contour (ft amsl); Dashed Where Inferred

N

Table Notes:
Results shaded red are detected values above the Groundwater Standard (Regulation 41: Table A Ground water Organic Chemical Standards, and Table 1 Domestic Water Supply - Human Health Standards)
< - Compound not detected at the laboratory Reporting Limit
Results with red text are reporting limits that are > the standard
J - Laboratory Qualifier; Estimated concentration detected above the method detection limit (MDL) but below the reporting limit (RL).

0 100 200
Feet

References:
1. Quest and SEC monitoring well locations were obtained from Figure 2-1 titles "Red Tail Ranch Figure 2-1 Well Locations & Test Borings/Pits" developed by Stewart Environmental Consultants (SEC), LLC, dated January 2018. Locations are approximate.

2. Electromagnetic (EM) Survey Contours were generated based on EM surveys performed between 11 July and 13 July 2017, and on 1 December 2017 by National GPR Services.

3. Topography provided by Stewart Environmental Consultants SEC), LLC. Projection in NAD 1983 State Plane Colorado North U.S. Feet.

4. Groundwater contours are interpreted by Geosyntec based on Groundwater elevation data obtained on 12 November 2018 during the corrective measures work plan field investigation.

5. Aerial photograph was obtained from Google Earth 2017.

Pinyon Report
Figure 4b
Groundwater Monitoring Well Map
(Geosyntec, 2020a)

Geosyntec consultants	Figure 2-4	May 2020
	DE0344	Rev. 1

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Pinyon Report
Figure 5a
Drum and Sludge Removal Areas
(Geosyntec, 2018)

Stratus Redtail Ranch
2259 County Road 5, Erie, CO

Site Plan and Excavation Areas

Geosyntec consultants	Figure 2	8/3/2018
	DE0302	

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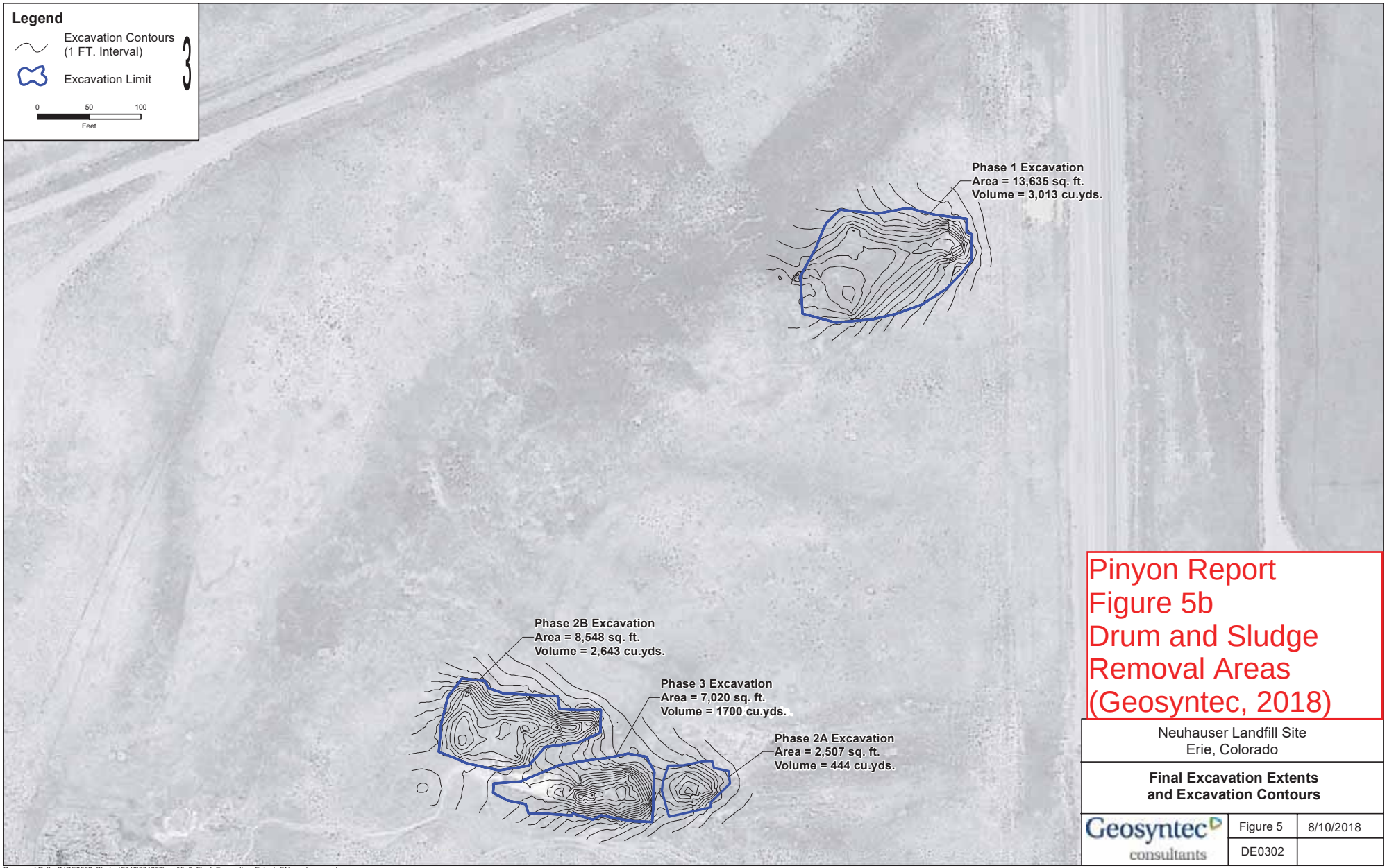

Pinyon Report
Figure 5b
Drum and Sludge Removal Areas (Geosyntec, 2018)

Neuhauser Landfill Site
Erie, Colorado

Final Excavation Extents and Excavation Contours

Geosyntec consultants	Figure 5	8/10/2018
	DE0302	

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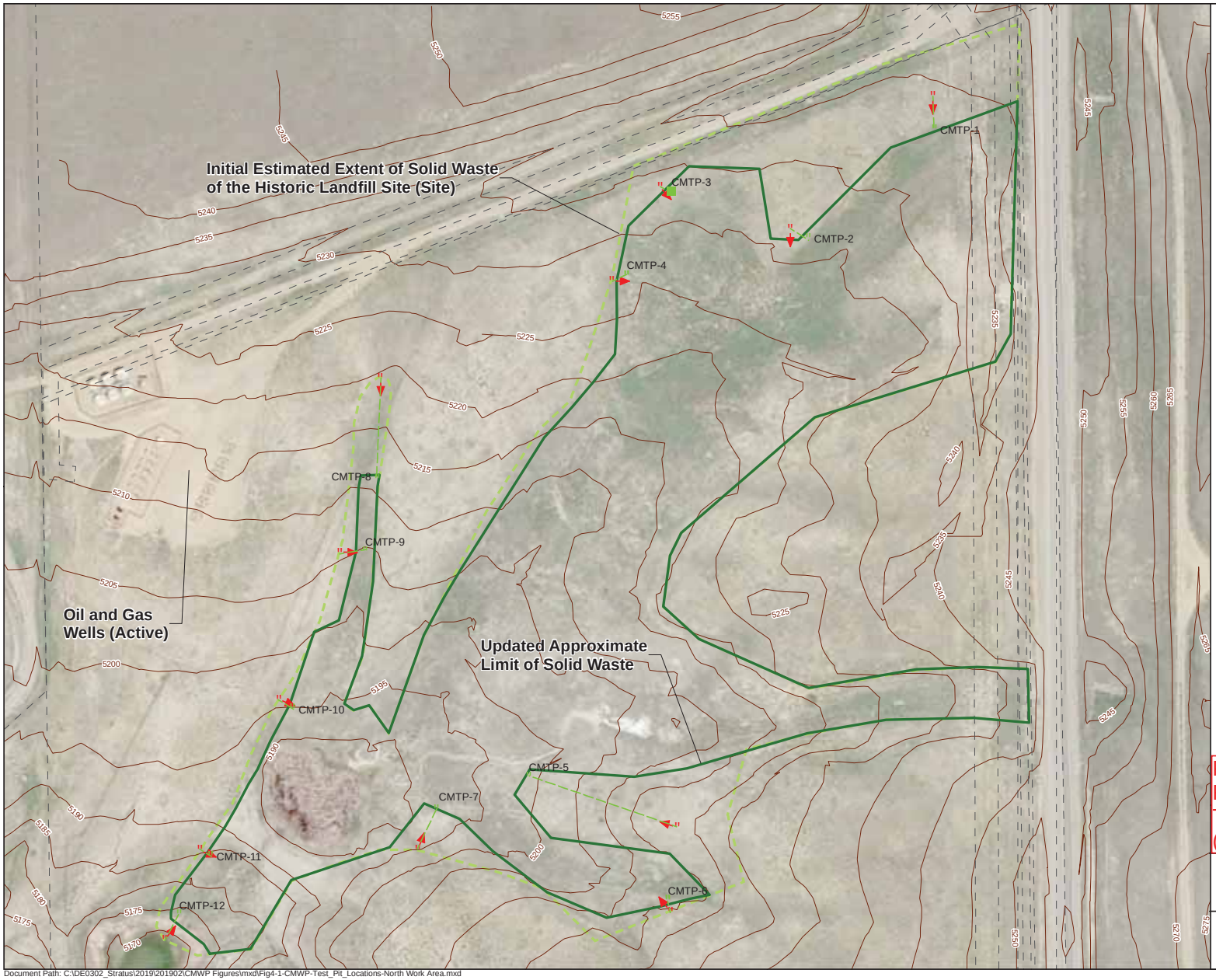


Legend

- Test Pit with Directional Dig Arrows
- Test Pit and Surveyed Location of Edge of Solid Waste
- Existing Surface Contours
- Initial Estimated Extent of Solid Waste
- Extent of Solid Waste (Note 1)

0 100 200
Feet

3

Notes:
1. The Extent of Solid Waste is based on the surveyed location of the edge of solid waste identified during the Corrective Measures Work Plan field work, test pit observations made during previous site investigations, and discussions with CDPHE.

2. Edge of Solid Waste locations were verified by a GPS survey conducted by CWC Consulting Group on 4 and 5 December 2018.

3. Topography provided by Stewart Environmental Consultants (SEC), LLC . Projection in NAD 1983 State Plane Colorado North U.S. Feet.

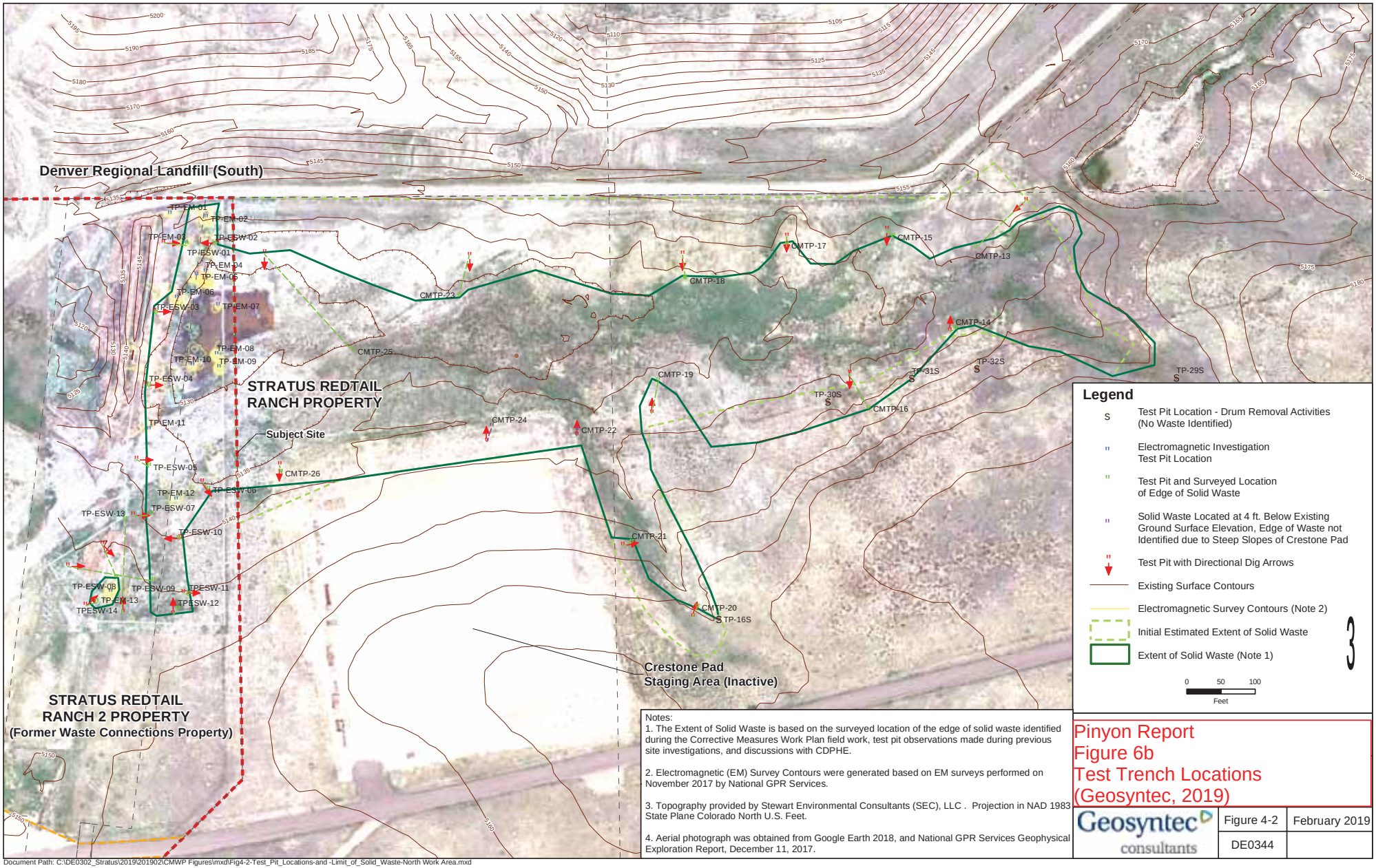
4. Aerial photograph was obtained from Google Earth 2018.

Pinyon Report
Figure 6a
Test Trench Locations
(Geosyntec, 2019)

Test Pit Locations and Extents of Solid Waste North Work Area

Geosyntec consultants	Figure 4-1	February 2019
	DE0344	

Document Path: C:\DE0302_Stratus\2019\201902\CMWP Figures\mxd\Fig4-1-CMWP-Test_Pit_Locations-North Work Area.mxd



Legend

- S — Test Pit Location - Drum Removal Activities (No Waste Identified)
- " — Electromagnetic Investigation Test Pit Location
- " — Test Pit and Surveyed Location of Edge of Solid Waste
- " — Solid Waste Located at 4 ft. Below Existing Ground Surface Elevation, Edge of Waste not Identified due to Steep Slopes of Crestone Pad
- " — Test Pit with Directional Dig Arrows
- Existing Surface Contours
- Electromagnetic Survey Contours (Note 2)
- Initial Estimated Extent of Solid Waste
- Extent of Solid Waste (Note 1)

0 50 100
Feet

3

Notes:
1. The Extent of Solid Waste is based on the surveyed location of the edge of solid waste identified during the Corrective Measures Work Plan field work, test pit observations made during previous site investigations, and discussions with CDPHE.

2. Electromagnetic (EM) Survey Contours were generated based on EM surveys performed on November 2017 by National GPR Services.

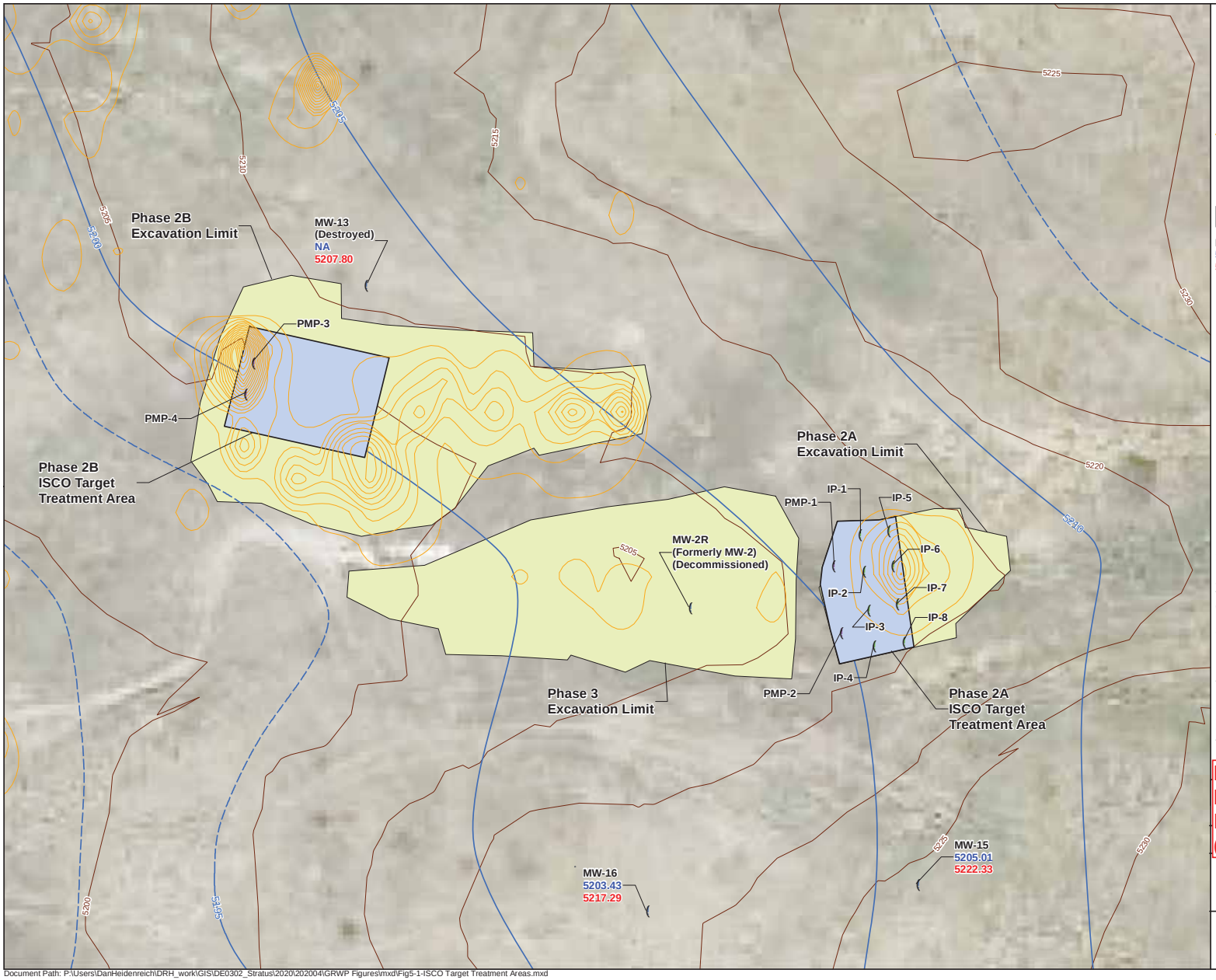
3. Topography provided by Stewart Environmental Consultants (SEC), LLC . Projection in NAD 1983 State Plane Colorado North U.S. Feet.

4. Aerial photograph was obtained from Google Earth 2018, and National GPR Services Geophysical Exploration Report, December 11, 2017.

Pinyon Report
Figure 6b
Test Trench Locations
(Geosyntec, 2019)

Geosyntec consultants	Figure 4-2	February 2019
	DE0344	

Document Path: C:\DE0302_Stratus\2019\201902\CMWP Figures\mxd\Fig4-2-Test_Pit_Locations-and -Limit_of_Solid_Waste-North Work Area.mxd



Legend

- SEC Monitoring Well Location
- Temporary Performance Monitoring Point
- Injection Point
- Electromagnetic Survey Contours
- Existing Surface Contours
- EPA AOC Drum Removal Excavation Limits
- ISCO Target Treatment Area
- MW-16 / 5203.43 / 5217.29 — Groundwater Monitoring Well along with Groundwater Elevation (blue - ft amsl) and Bedrock Elevation (red - ft amsl)
- Groundwater Elevation Contour (ft amsl); Dashed where inferred

0 20 40
Feet

3

References:

1. Quest and SEC monitoring well locations were obtained from Figure 2-1 titles "Red Tail Ranch Figure 2-1 Well Locations & Test Borings/Pits" developed by Stewart Environmental Consultants (SEC), LLC, dated January 2018. Locations are approximate.

2. EPA AOC Drum Removal Excavation Limits were obtained using hand-held GPS tracking equipment between November 2017 and April 2018 by Geosyntec Consultants. Vertical information for these locations obtained from the GPS equipment shown on these drawings refers to the World Geodetic System 1984 (WGS84).

3. Electromagnetic (EM) Survey Contours were generated based on EM surveys performed between 11 July and 13 July 2017, and on 1 December 2017 by National GPR Services.

4. Topography provided by Stewart Environmental Consultants SEC), LLC. Projection in NAD 1983 State Plane Colorado North U.S. Feet.

5. Groundwater contours are interpreted by Geosyntec based on Groundwater elevation data obtained on 12 November 2018 during the corrective measures work plan field investigation.

Pinyon Report
Figure 7
ISCO Treatment Areas
(Geosyntec, 2020a)

Target Treatment Areas for Groundwater Remediation

Geosyntec consultants	Figure 5-1	May 2020
	DE0344	Rev. 1

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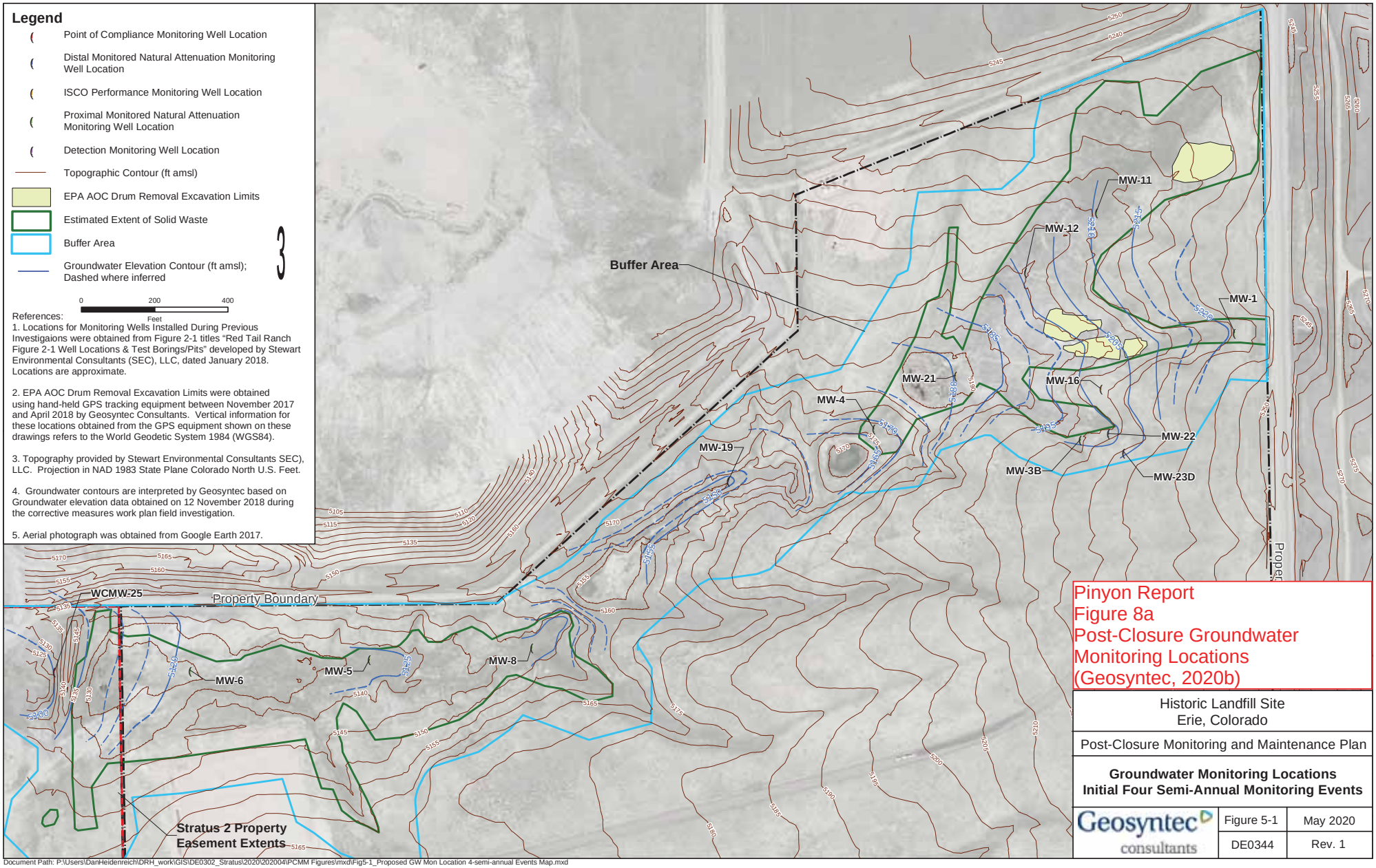
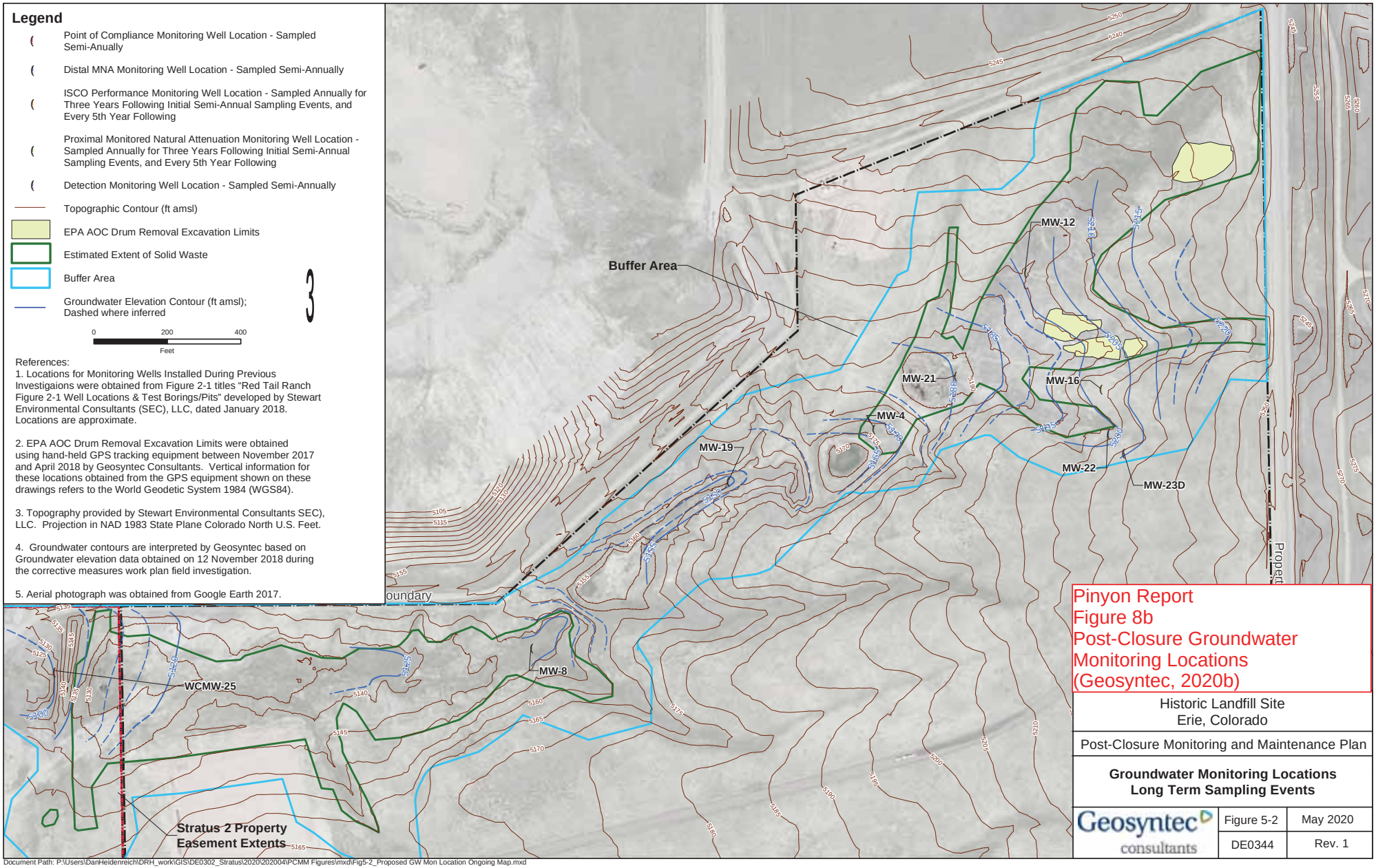
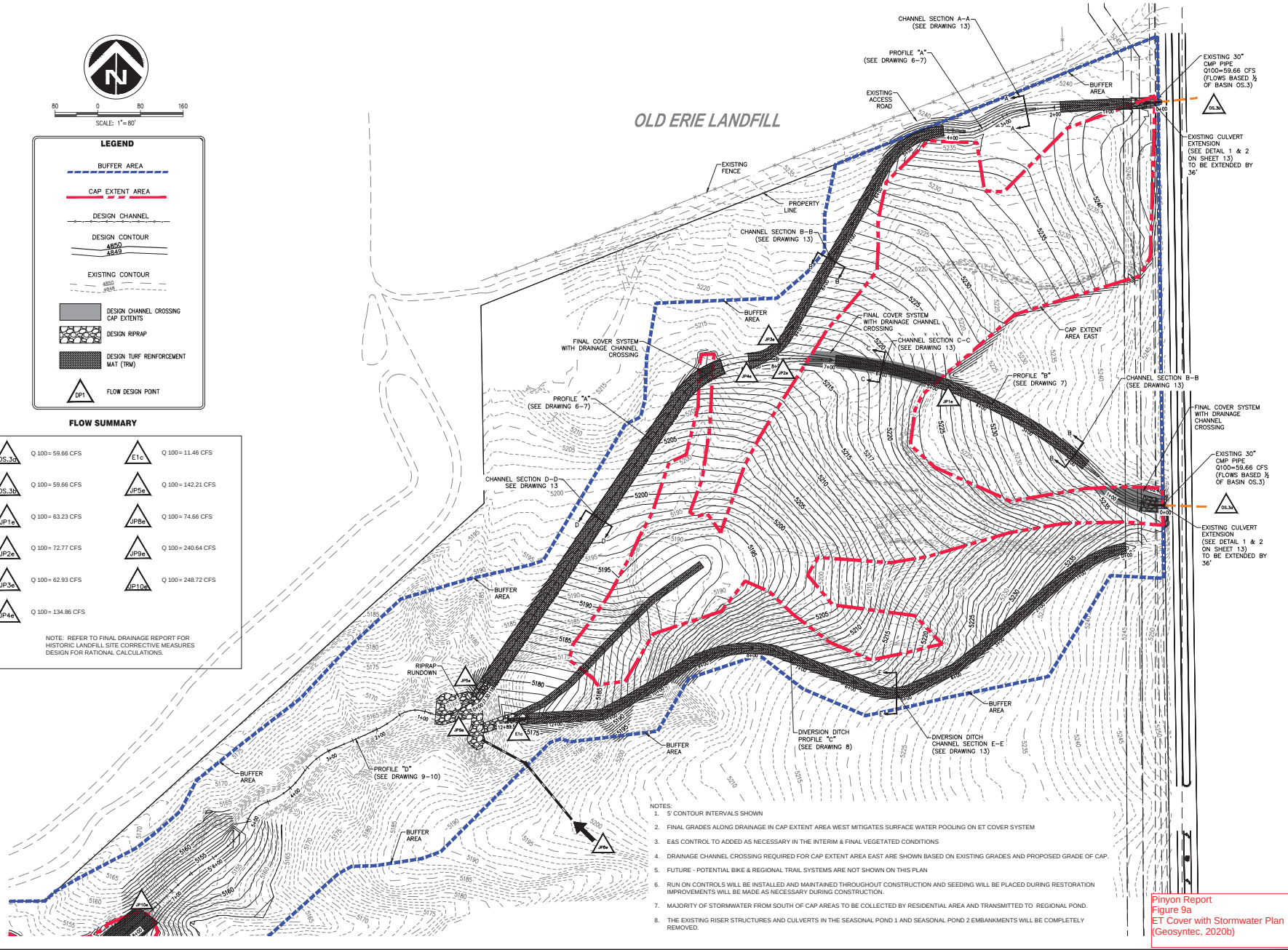

Legend
Point of Compliance Monitoring Well Location
Distal Monitored Natural Attenuation Monitoring Well Location
ISCO Performance Monitoring Well Location
Proximal Monitored Natural Attenuation Monitoring Well Location
Detection Monitoring Well Location
Topographic Contour (ft amsl)
EPA AOC Drum Removal Excavation Limits
Estimated Extent of Solid Waste
Buffer Area
Groundwater Elevation Contour (ft amsl); Dashed where inferred
0
200
400
Feet
References:
1. Locations for Monitoring Wells Installed During Previous Investigaions were obtained from Figure 2-1 titles "Red Tail Ranch Figure 2-1 Well Locations & Test Borings/Pits" developed by Stewart Environmental Consultants (SEC), LLC, dated January 2018. Locations are approximate.
2. EPA AOC Drum Removal Excavation Limits were obtained using hand-held GPS tracking equipment between November 2017 and April 2018 by Geosyntec Consultants. Vertical information for these locations obtained from the GPS equipment shown on these drawings refers to the World Geodetic System 1984 (WGS84).
3. Topography provided by Stewart Environmental Consultants SEC), LLC. Projection in NAD 1983 State Plane Colorado North U.S. Feet.
4. Groundwater contours are interpreted by Geosyntec based on Groundwater elevation data obtained on 12 November 2018 during the corrective measures work plan field investigation.
5. Aerial photograph was obtained from Google Earth 2017.
Buffer Area
MW-11
MW-12
MW-1
MW-21
MW-16
MW-4
MW-19
MW-22
MW-3B
MW-23D
WCMW-25
Property Boundary
MW-5
MW-8
MW-6
Stratus 2 Property Easement Extents
Pinyon Report
Figure 8a
Post-Closure Groundwater Monitoring Locations
(Geosyntec, 2020b)
Historic Landfill Site
Erie, Colorado
Post-Closure Monitoring and Maintenance Plan
Groundwater Monitoring Locations
Initial Four Semi-Annual Monitoring Events
Geosyntec consultants
Figure 5-1
May 2020
DE0344
Rev. 1
Document Path: P:\Users\DanHeidenreich\DRH_work\GIS\DE0302_Stratus\2020\202004\PCMM Figures\mxd\Fig5-1_Proposed GW Mon Location 4-semi-annual Events Map.mxd


Legend
Point of Compliance Monitoring Well Location - Sampled Semi-Anually
Distal MNA Monitoring Well Location - Sampled Semi-Annually
ISCO Performance Monitoring Well Location - Sampled Annually for Three Years Following Initial Semi-Annual Sampling Events, and Every 5th Year Following
Proximal Monitored Natural Attenuation Monitoring Well Location - Sampled Annually for Three Years Following Initial Semi-Annual Sampling Events, and Every 5th Year Following
Detection Monitoring Well Location - Sampled Semi-Annually
Topographic Contour (ft amsl)
EPA AOC Drum Removal Excavation Limits
Estimated Extent of Solid Waste
Buffer Area
Groundwater Elevation Contour (ft amsl); Dashed where inferred
0
200
400
Feet
References:
1. Locations for Monitoring Wells Installed During Previous Investigaions were obtained from Figure 2-1 titles "Red Tail Ranch Figure 2-1 Well Locations & Test Borings/Pits" developed by Stewart Environmental Consultants (SEC), LLC, dated January 2018. Locations are approximate.
2. EPA AOC Drum Removal Excavation Limits were obtained using hand-held GPS tracking equipment between November 2017 and April 2018 by Geosyntec Consultants. Vertical information for these locations obtained from the GPS equipment shown on these drawings refers to the World Geodetic System 1984 (WGS84).
3. Topography provided by Stewart Environmental Consultants SEC), LLC. Projection in NAD 1983 State Plane Colorado North U.S. Feet.
4. Groundwater contours are interpreted by Geosyntec based on Groundwater elevation data obtained on 12 November 2018 during the corrective measures work plan field investigation.
5. Aerial photograph was obtained from Google Earth 2017.
Buffer Area
MW-12
MW-21
MW-16
MW-4
MW-19
MW-22
MW-23D
MW-8
WCMW-25
Stratus 2 Property Easement Extents
oundary
Propert
Pinyon Report
Figure 8b
Post-Closure Groundwater Monitoring Locations
(Geosyntec, 2020b)
Historic Landfill Site
Erie, Colorado
Post-Closure Monitoring and Maintenance Plan
Groundwater Monitoring Locations
Long Term Sampling Events
Geosyntec consultants
Figure 5-2
May 2020
DE0344
Rev. 1
Document Path: P:\Users\DanHeidenreich\DRH_work\GIS\DE0302_Stratus\2020\202004\PCMM Figures\mxd\Fig5-2_Proposed GW Mon Location Ongoing Map.mxd



Pinyon Report
Figure 9a
ET Cover with Stormwater Plan
(Geosyntec, 2020b)

DOCUMENT AMENDMENTS

No.	Date	Description
3	10/30/2020	ISSUE FOR PUBLIC COMMENT
2	10/07/2020	DRAFT ANTICIPATED TO PUBLIC COMMENT
1	05/01/2020	

STRATUS REDTAIL RANCH, LLC
8480 EAST ORCHARD ROAD
SUITE 1100
GREENWOOD VILLAGE, CO 80111
PHONE: (720) 214-5000
CONTACT: RICHARD DEAN

EVAPOTRANSPIRATION COVER AND STORMWATER GRADING PLAN - EAST

CWC CONSULTING GROUP
CIVIL ENGINEERING • LAND SURVEYING • CONSTRUCTION SERVICES
8500 TEDD'S LANE
SUITE 4070
LONE TREE, COLORADO
80124
TELEPHONE: 303-395-2700
FAX: 303-395-2710

PRELIMINARY NOT FOR CONSTRUCTION

Project Number: 130-00011
Designed By: JEC
Drawn By: JEC
Reviewed By: BAW
Drawing Number: 4 OF 26

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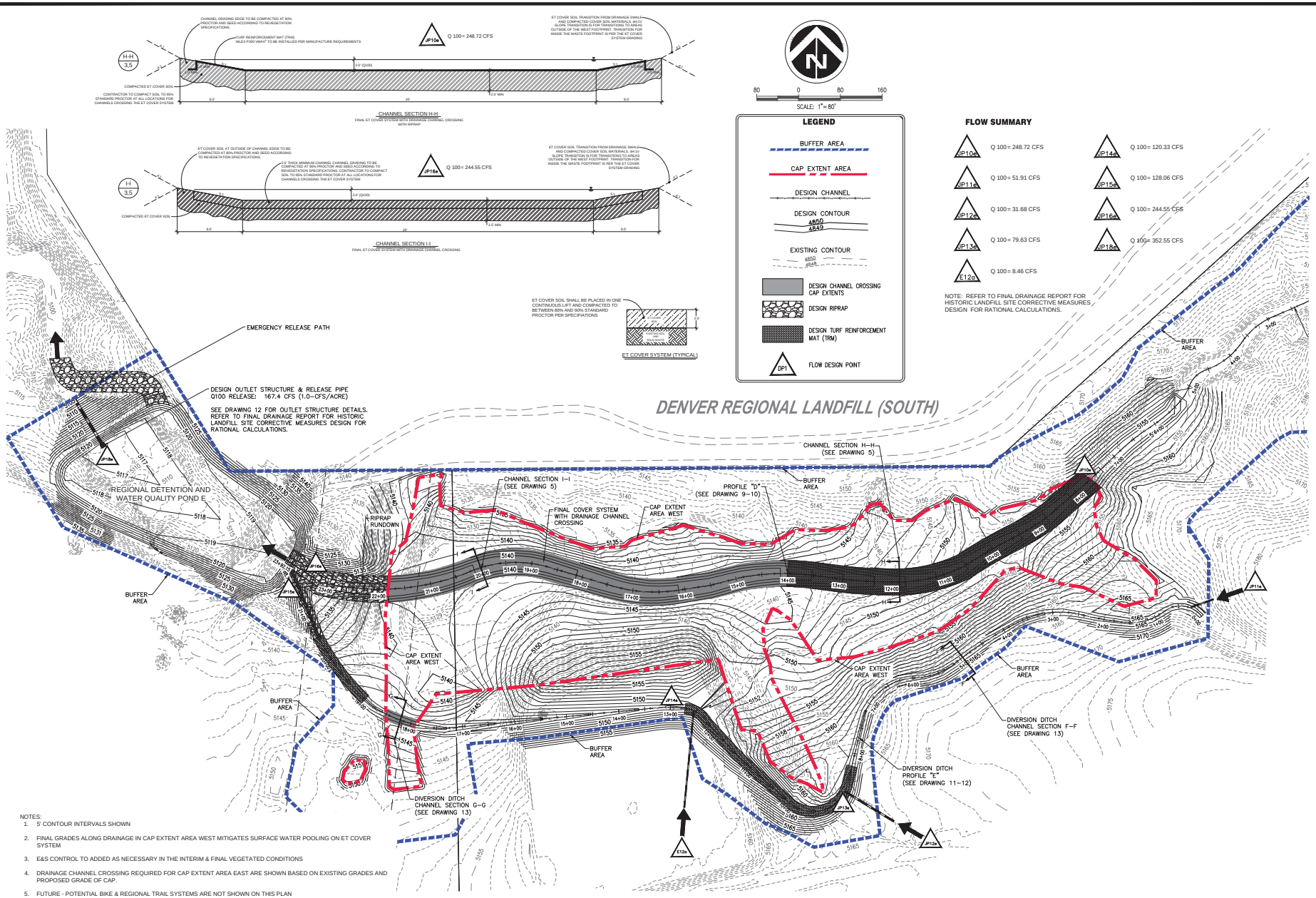

NOTES:

1. 5' CONTOUR INTERVALS SHOWN
2. FINAL GRADES ALONG DRAINAGE IN CAP EXTENT AREA WEST MITIGATES SURFACE WATER POOLING ON ET COVER SYSTEM
3. E&S CONTROL TO ADDED AS NECESSARY IN THE INTERIM & FINAL VEGETATED CONDITIONS
4. DRAINAGE CHANNEL CROSSING REQUIRED FOR CAP EXTENT AREA EAST ARE SHOWN BASED ON EXISTING GRADES AND PROPOSED GRADE OF CAP.
5. FUTURE - POTENTIAL BIKE & REGIONAL TRAIL SYSTEMS ARE NOT SHOWN ON THIS PLAN
6. RUN ON CONTROLS WILL BE INSTALLED AND MAINTAINED THROUGHOUT CONSTRUCTION AND SEEDING WILL BE PLACED DURING RESTORATION IMPROVEMENTS WILL BE MADE AS NECESSARY DURING CONSTRUCTION.
7. MAJORITY OF STORMWATER FROM SOUTH OF CAP AREAS TO BE COLLECTED BY RESIDENTIAL AREA AND TRANSMITTED TO REGIONAL POND.
8. THE EXISTING RISER STRUCTURES AND CULVERTS IN THE SEASONAL POND 3 AND SEASONAL POND 4 EMBANKMENTS NEAR STATIONS 7+00 AND 22+00, RESPECTIVELY, WILL BE COMPLETELY REMOVED.

No.	Date	Description
1	05/01/2020	ISSUE ANTICIPATED TO PAY E COMMENT
0	03/27/2020	ISSUE FOR PUBLIC COMMENT

DOCUMENT AMENDMENTS

STRATUS REDTAIL RANCH, LLC
8480 EAST ORCHARD ROAD SUITE 1100
GREENWOOD VILLAGE, CO 80111
PHONE: (720) 214-5000
CONTACT: RICHARD DEAN

EVAPOTRANSPIRATION COVER AND STORMWATER GRADING PLAN - WEST

8900 TEDD'S LANE
SUITE 4203
LONE TREE, COLORADO
80124
TELEPHONE: 303-395-2700
FAX: 303-395-2710
CWC CONSULTING GROUP
CIVIL ENGINEERING - LAND SURVEYING - CONSTRUCTION SERVICES

PRELIMINARY - NOT FOR CONSTRUCTION

Project Number: 130-00011
Designed By: JEC
Drawn By: JEC
Reviewed By: BAW
Drawing Number: 5 OF 26

Pinyon Report
Figure 9b
ET Cover with Stormwater Plan
(Geosyntec, 2020b)

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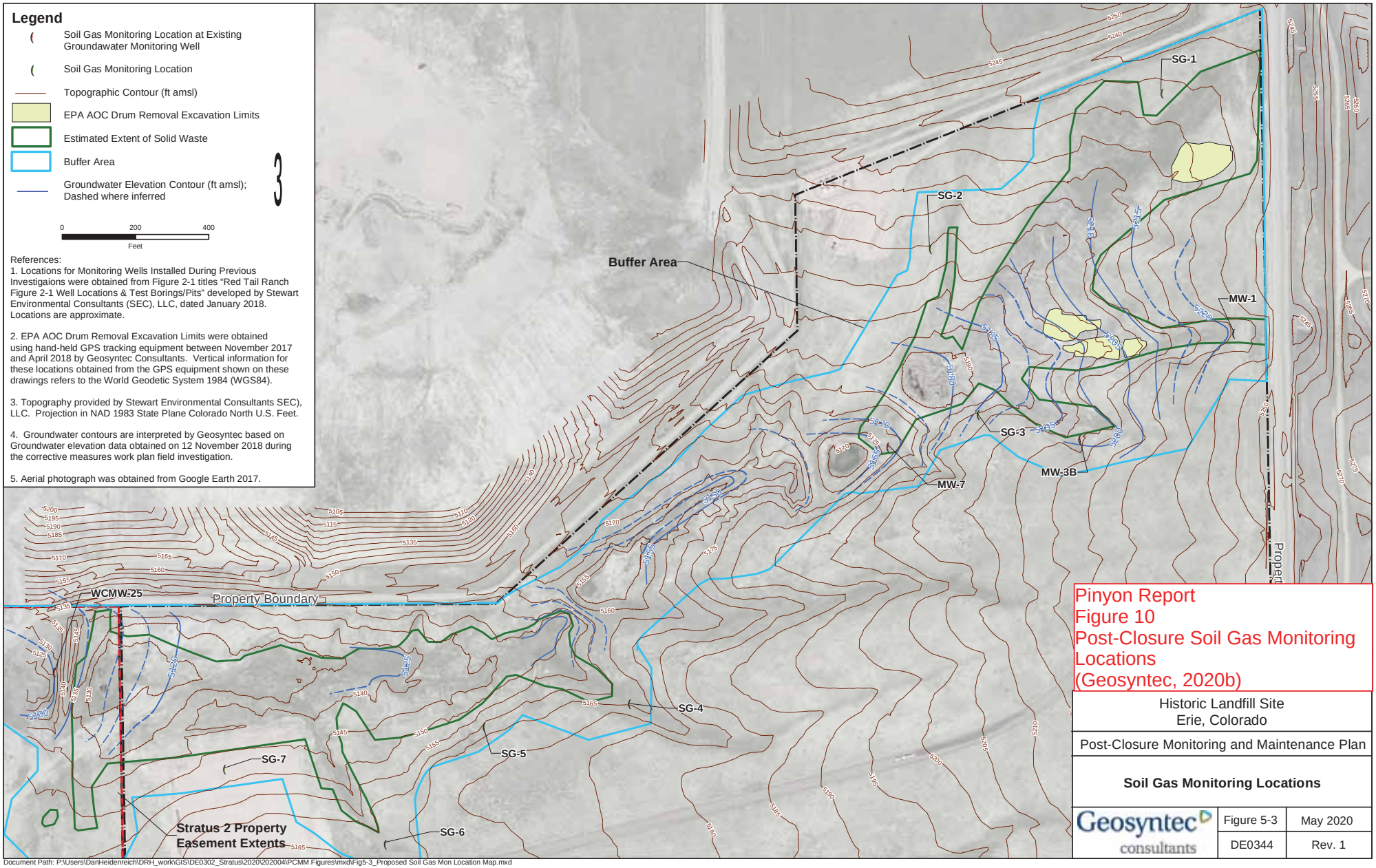

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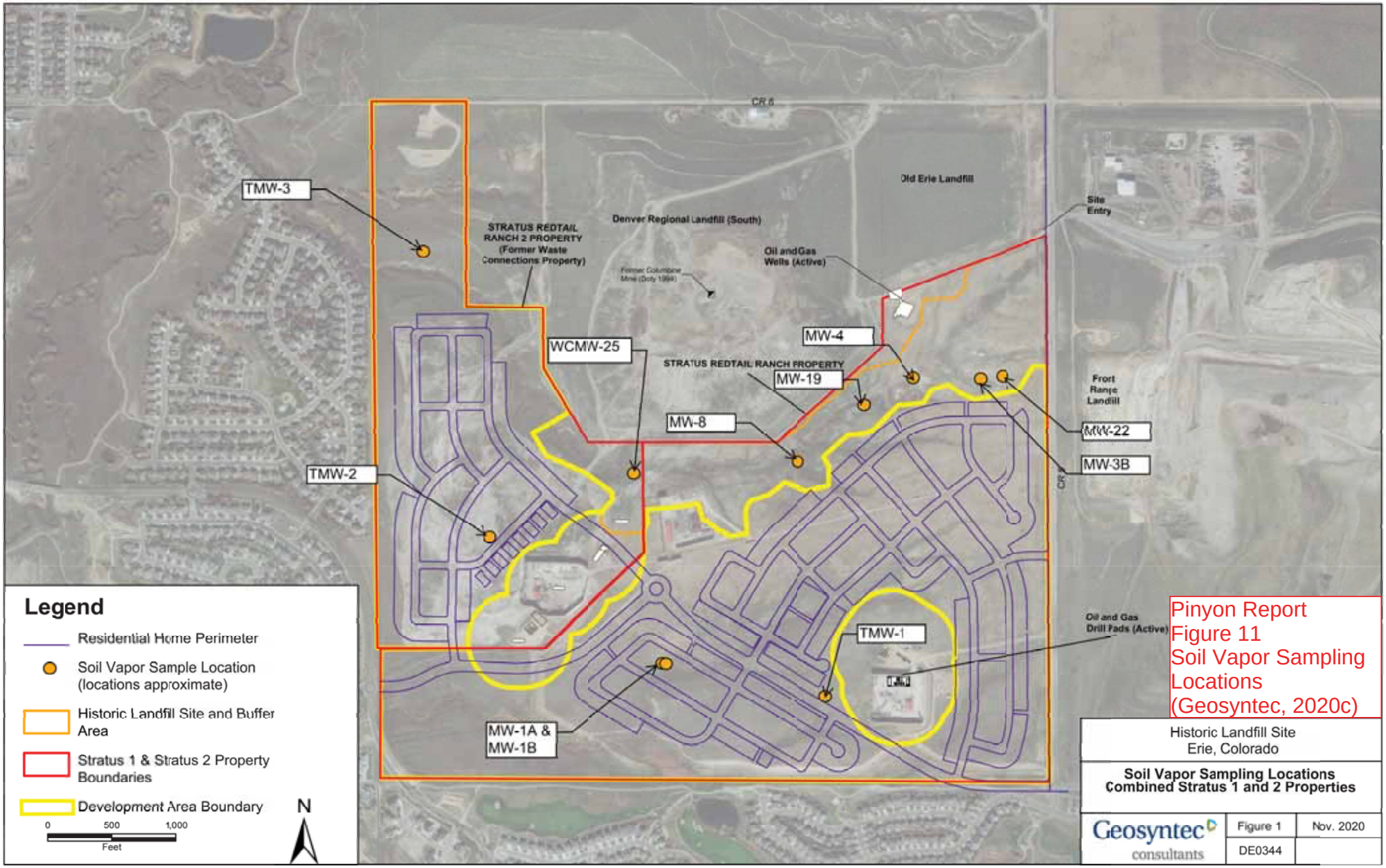
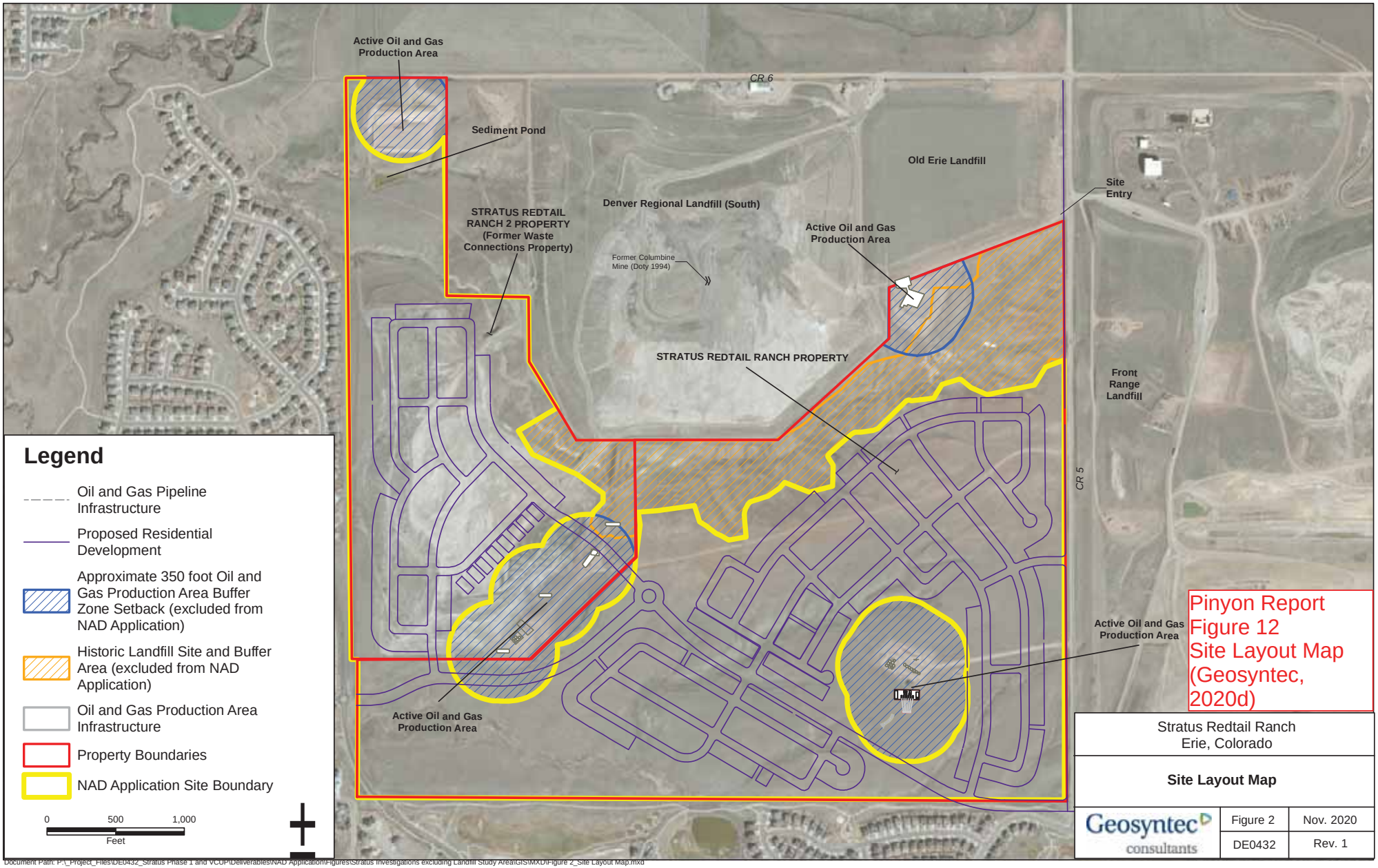


Pinyon Report
Figure 11
Soil Vapor Sampling
Locations
(Geosyntec, 2020c)

Historic Landfill Site
Erie, Colorado

Soil Vapor Sampling Locations
Combined Stratus 1 and 2 Properties

Geosyntec consultants	Figure 1	Nov. 2020
	DE0344	



Pinyon Report
Figure 12
Site Layout Map
(Geosyntec, 2020d)

Stratus Redtail Ranch Erie, Colorado		
Site Layout Map		
Geosyntec consultants	Figure 2	Nov. 2020
	DE0432	Rev. 1

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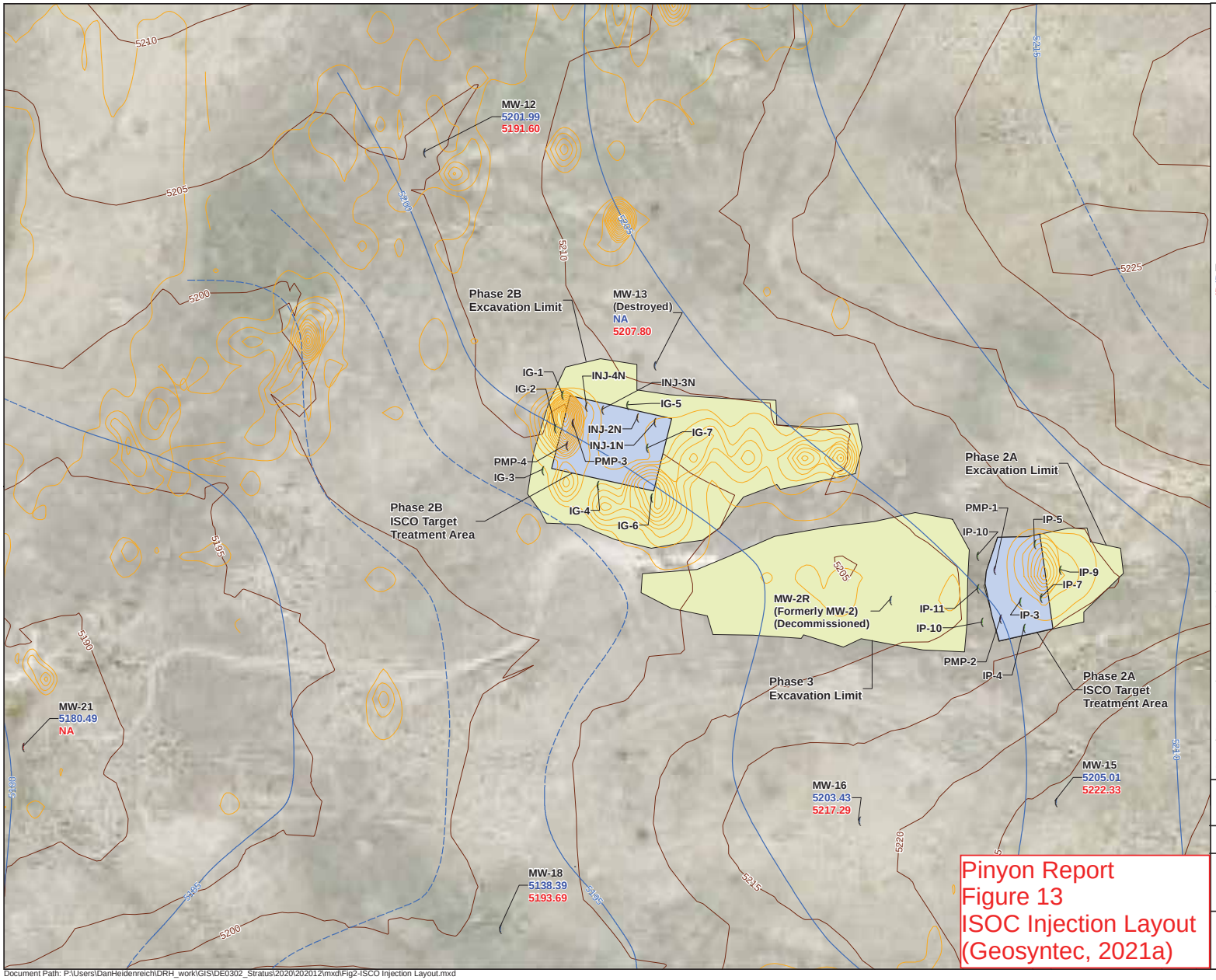


Legend

- SEC Monitoring Well Location
- Geosyntec Shallow Monitoring Well Location
- Temporary Performance Monitoring Point
- Direct Push Injection Point
- Injection Gallery Injection Point
- Electromagnetic Survey Contours
- Existing Surface Contours
- EPA AOC Drum Removal Excavation Limits
- ISCO Target Treatment Area
- MW-16 / 5203.43 / 5217.29 — Groundwater Monitoring Well along with Groundwater Elevation (blue - ft amsl) and Bedrock Elevation (red - ft amsl)
- Groundwater Elevation Contour (ft amsl); Dashed where inferred

0 20 40
Feet

3

References:

1. Quest and SEC monitoring well locations were obtained from Figure 2-1 titles "Red Tail Ranch Figure 2-1 Well Locations & Test Borings/Pits" developed by Stewart Environmental Consultants (SEC), LLC, dated January 2018. Locations are approximate.

2. EPA AOC Drum Removal Excavation Limits were obtained using hand-held GPS tracking equipment between November 2017 and April 2018 by Geosyntec Consultants. Vertical information for these locations obtained from the GPS equipment shown on these drawings refers to the World Geodetic System 1984 (WGS84).

3. Electromagnetic (EM) Survey Contours were generated based on EM surveys performed between 11 July and 13 July 2017, and on 1 December 2017 by National GPR Services.

4. Topography provided by Stewart Environmental Consultants SEC), LLC. Projection in NAD 1983 State Plane Colorado North U.S. Feet.

5. Groundwater contours are interpreted by Geosyntec based on Groundwater elevation data obtained on 12 November 2018 during the corrective measures work plan field investigation.

6. Aerial photograph was obtained from Google Earth 2017.

Historic Landfill Site
Erie, Colorado

ISCO Implementation Report

ISCO Injection Layout

Pinyon Report
Figure 13
ISOC Injection Layout
(Geosyntec, 2021a)

Geosyntec consultants	Figure 2	Feb 2021
	DE0344	Rev. 0

Document Path: P:\Users\DanHeidenreich\DRH_work\GIS\DE0302_Stratus\2020\202012\mxd\Fig2-ISCO Injection Layout.mxd

Threatened & Endangered Species, Habitat & Wetlands Report
and
Native & Specimen Tree & Vegetation Survey & Protection Plan

Redtail Ranch Filing No. 1
Erie, Colorado

November 15, 2019

Prepared for:

Stratus Redtail Ranch, LLC
1842 Montane Drive East
Golden, CO 80401

Prepared by:

ecos ecosystem services LLC

1455 Washburn Street
Erie, Colorado 80516
(p): 970-812-3267

Project Number: 2019-5-1

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACROYNMS AND ABBREVIATIONS

AMSL	above mean sea level
BGEPA	Bald and Golden Eagle Protection Act
CDA	Colorado Department of Agriculture
CNHP	Colorado Natural Heritage Program
COGCC	Colorado Oil and Gas Conservation Commission
CPW	Colorado Parks and Wildlife
CWA	Clean Water Act
Ecos or ecos	Ecosystem Services, LLC
JD	Jurisdictional Determination under the Clean Water Act
MBTA	Migratory Bird Treaty Act
Non-JD	Non-Jurisdictional Determination under the Clean Water Act
OHWM	Ordinary High Water Mark
PMJM	Preble's meadow jumping mouse
Site	Redtail Ranch Filing No. 1
NRCS	Natural Resource Conservation Service
NWI	National Wetland Inventory
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

1.0 INTRODUCTION

Ecosystem Services, LLC (Ecos or ecos) was retained by Stratus Redtail Ranch, LLC (Stratus) to provide environmental support services for Redtail Ranch Filing No. 1 (Project) (Site). This Threatened & Endangered Species, Habitat & Wetlands Report and Native & Specimen Tree & Vegetation Survey & Protection Plan (Report) has been prepared for the Preliminary Plat review process per Town of Erie (Erie) requirements.

The contact information for the Stratus Redtail Ranch, LLC and ecos representatives for this Report is provided below:

Client

Richard Dean
Stratus Canyon Creek, LLC
1842 Montane Drive East
Golden, CO 80401
Phone: (720) 214-5000
rdean@stratuscompanies.com

Agent

Grant E. Gurnée, P.W.S.
Ecosystem Services, LLC
1455 Washburn Street
Erie, Colorado 80516
Phone: (970) 812-6167
grant@ecologicalbenefits.com

1.1 Purpose

The purpose of this Report is to identify and document the natural resources, ecological characteristics and existing conditions of the Site; identify potential ecological impacts associated with Site development; identify potential archaeological resources; and provide current regulatory guidance related to potential development-related impacts to natural resources. This Report and associated mapping do not represent a formal presence/absence survey for threatened and endangered species and therefore are not suitable for regulatory submission to the United States Fish and Wildlife Service (USFWS). The wetland and waters boundary delineation and report referenced herein is suitable for regulatory submission to the US Army Corps of Engineers (USACE) to support a 404 Permit application, if necessary. The specific resources addressed in this Report are per the Town of Erie Development Design Standards, Chapter 6, Section 10.6.2 Natural and Scenic Resource Protection.

1.2 Project Description and Site Location

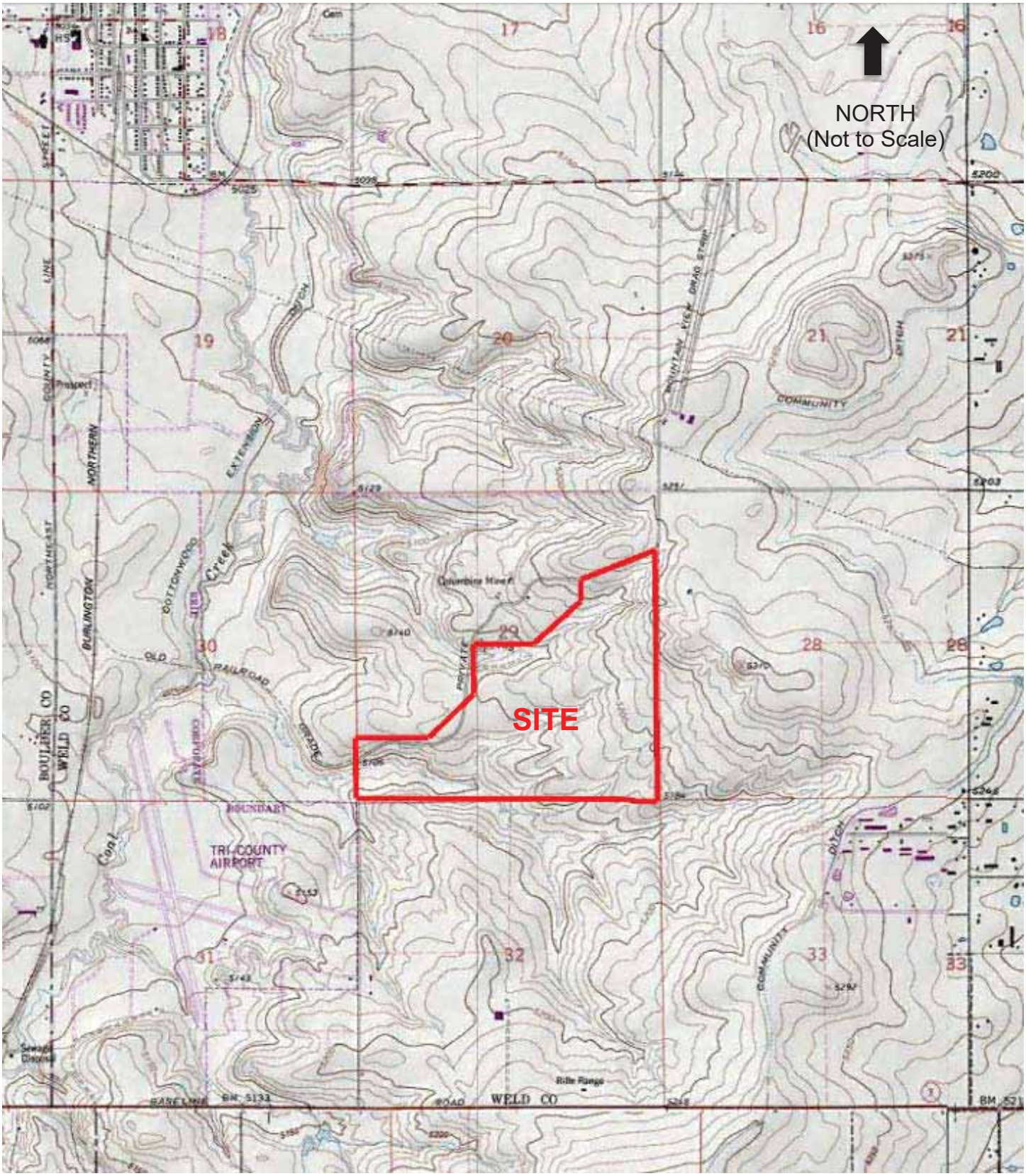
The Applicant proposes to develop the Redtail Ranch Filing No. 1 as a planned residential community with associated infrastructure including roads, trails, stormwater management, and open space. The Project is described and plans are illustrated in greater detail in the development application.

The 295-acre Site is in the Town of Erie, Boulder County, Colorado. The Site is located within Section 29, Township 1 North, Range 68 West. Please refer to Figure 1, USGS Site Location Map and Figure 2, Existing Conditions Aerial Photo for location and general site conditions. The longitude and latitude of the Site at its center are 105.025000° west and 40.019275° north.

The Site is located in the Town of Erie northwest of the intersection of Weld County Roads 4 and 5 (Figure 2). The Site is bordered to the north by the Denver Regional Landfill; the east by Weld County Road 5 and the Front Range Landfill; the south by Vista Ridge neighborhood/Colorado National Golf Club; and the west by the Vista Point neighborhood. Vista Parkway abuts the southwest corner of the Site.

Figure 1

USGS SITE LOCATION MAP



USGS 7.5 min. Quad: Erie
Latitude: 40.019275°N Longitude: -105.025000°W

Figure 1 USGS SITE LOCATION MAP

Figure 2

EXISTING CONDITIONS AERIAL PHOTO

SOURCE: Google Earth Aerial Image, 5/31/18

Figure 2 EXISTING CONDITIONS AERIAL PHOTO

2.0 METHODOLOGY

Ecos performed an office assessment in which available databases, resources, literature and field guides on local flora and fauna were reviewed to gather background information on the environmental setting of the Site. We consulted several organizations, previous studies, agencies and their databases, including but not limited to:

- Town of Erie UDC, Chapter 6, Section 10.6.2 Natural and Scenic Resource Protection;
- Town of Erie Planning & Development Department;
- Town of Erie Natural Areas Inventory
- USFWS Information for Planning and Consultation (IPaC);
- Colorado Parks Division of and Wildlife (CPW) wildlife corridors and habitat mapping;
- U.S. Geological Survey (USGS) Topographic Quadrangles;
- Natural Resource Conservation Service (NRCS) soil maps;
- USFWS National Wetland Inventory (NWI) maps;
- Colorado Natural Heritage Program (CNHP) wetland and riparian habitat mapping;
- Colorado Oil and Gas Conservation Commission (COGCC) raptor data;
- USDA PLANTS Database
- Wetland Report prepared by Alpine Ecological Resources, LLC;
- Approved Jurisdictional Determination for Redtail Ranch (USACE File No. NOW-2015-00393-DEN);
- Initial Site Assessment (ISA) Report, Pratt Well Pad Site prepared by Ecosystem Services, LLC
- Google Earth aerial imagery

The above data were used to create a preliminary natural resources map including vegetation communities, trees, prairie dog colonies, known raptor nests, wetlands, drainages, and ditches. The preliminary mapping was printed on aerial photographs and downloaded to a mobile phone GPS application for field proofing.

The Site was visited on October 25, 2019. Field reconnaissance concentrated on identifying major vegetation communities, including species composition and habitat suitability for nesting birds and threatened and endangered species. Open water, drainages, and wetland features were verified in the field utilizing wetland delineation data and mapping prepared previously by Alpine Ecological Resources and a U.S. Army Corps of Engineers (USACE) Approved Jurisdictional Determination of Waters of the United States. Representative photographs were taken throughout the Site to assist in documenting existing conditions.

Per the Town of Erie requirements for “Native and Specimen Tree and Vegetation Protection”, all trees within potential impact areas were assessed to determine the species and condition. An inventory of trees on or immediately adjacent to the Site that could be impacted by site development are described in Section 3.3 below.

3.0 EXISTING HABITAT

3.1 Upland Habitat

Historically, short- and mixed-grass prairie were the dominant habitat types on Colorado's eastern plains, and the Town of Erie. Historic uses of the Site (i.e., prior to establishment of the adjacent landfill and current well pads) likely included non-crop land, rangeland for livestock grazing, as well as native wildlife habitat.

The Erie Natural Areas Inventory (Town of Erie 2007) and the NRCS soils data (NRCS 2013) provide a comprehensive list of plant species that have been documented or are likely to be present on the Site or occur within 0.25 miles of the Site:

Common Name	**Scientific Name**
alyssum	*Alyssum spp*.
silver sagebrush	*Artemisia cana*
big sagebrush	*Artemisia tridentate*
*kochia	*Bassia sieversiana* (*Kochia sieversiana)*
buffalograss	*Bouteloua dactyloides*
blue grama	*Bouteloua gracilis* (*Chondrosum gracile)*
*Canada thistle	*Breea arvensis* (*Cirsium arvense*)
*cheatgrass	*Bromus tectorum*
*musk thistle	*Carduus nutans*
*lambsquarters	*Chenopodium album*
*goosefoot	*Chenopodium rubrum*
rabbitbrush	*Chrysothamnus nauseosa*
*field bindweed	*Convolvulus arvensis*
needle and thread	*Hesperostipa comata*
prairie Junegrass	*Koeleria macrantha*
*prickly lettuce	*Lactuca serriola*
alfalfa	*Medicago sativa*
western wheatgrass	*Pascopyrum smithii*
Plains cottonwood	*Populus deltoides*
bluebunch wheatgrass	*Pseudoroegneria spicata*
*curly dock	*Rumex crispus*
coyote willow	*Salix exigua*
*Russian thistle (tumbleweed)	*Salsola australis*
bulrush	*Schoenoplectus spp*.
tall tumble mustard	*Sisymbrium altissimum*
common wheat	*Triticum aestivum*
narrowleaf cattail	*Typha angustifolia*
broad-leaf cattail	*Typha latifolia*

Upland vegetation communities/land cover types observed on the Site include:

Bare Ground (BG) = BG consists of roads and oil and gas well pads and work areas covering approximately 10.5 acres out of a total of 295 acres (3.5%). These areas are not vegetated.

Xeric Midgrass Prairie (XMP): XMP is the largest plant community on the Site covering approximately 264.61 acres out of a total of 295 acres (89.7%). XMP has dry (xeric) soil conditions supporting semi-native midgrass prairie species listed below. XMP has been affected by persistent human disturbance and heavy prairie dog use in the northern 2/3^{rds} of the Site and is therefore weedy and in poor condition. XMP quality and cover is fair in non-prairie dog areas in the southern 1/3rd of the Site with occasional patches of weeds. Portions of XMP have recently been disturbed and reclaimed following installation of oil and gas pipelines and facilities.

Common Name	**Scientific Name**
alyssum	*Alyssum spp*.
oats	*Avena sp.*
Crested wheatgrass	*Agropyron cristatum*
*kochia	*Bassia sieversiana* (*Kochia sieversiana)*
blue grama	*Bouteloua gracilis* (*Chondrosum gracile)*
sideoats grama	*Bouteloua curtipendula*
*mustard	*Brassica spp.*
*Canada thistle	*Breea arvensis* (*Cirsium arvense*)
smooth brome	*Bromus inermis*
*cheatgrass	*Bromus tectorum*
*musk thistle	*Carduus nutans*
*field bindweed	*Convolvulus arvensis*
slender wheatgrass	*Elymus trachycaulus*
common sunflower	*Helianthus annuus*
*prickly lettuce	*Lactuca serriola*
sweetclover	*Melilotus spp.*
Plains pricklypear	*Opuntia polycantha*
western wheatgrass	*Pascopyrum smithii*
bluebunch wheatgrass	*Pseudoroegneria spicata*
*curly dock	*Rumex crispus*
rye	*Secale sp.*
*tall tumble mustard	*Sisymbrium altissimum*
*field pennycress	*Thlaspi arvense*
yucca	Y*ucca glauca*

Note: * indicates noxious, invasive and/or common weeds.

Figure 3, Vegetation Map illustrates the major upland vegetation communities listed above.

The recommended upland seed mix for the restoration of open space on the Site is based on the plant species present on the Site, within the region, as well as the NRCS soil data. Erie has recommended native seed mixes in their Standard Specifications for Design and Construction of Public Improvements, Section 1000 - Parks and Recreation Construction (Town of Erie 2013a) that are also applicable. The mixture included below is intended for seeding of open space and roadsides. It is an adaptable mix of short- to mid-grass native and introduced warm and cool season grasses. Agronomic soil testing should be performed in all restoration areas to assess the need for soil amendments prior to seeding. This mixture should be applied as a dormant seeding between October 30th and April 30th:

COMMON NAME	**SCIENTIFIC NAME**	**VARIETY**	**PLS LBS/ACRE**
Western wheatgrass	*Pascopyrum smithii*	Arriba, Oahe or Rosana	7.0
Crested wheatgrass	*Agropyron cristatum*	Ephriam	4.0
Streambank wheatgrass	*Elymus lanceolatus*	Sodar	4.0
Sideoats grama	*Bouteloua gracilis*	Butte, Niner or El Reno	2.0
Blue grama	*Bouteloua gracilis*	Lovington, Alma, Native or Hachita	5.0
Buffalograss	*Buchloe dactyloides*	Native, Bison or Texoka	3.0
Sand dropseed	*Sporobolus cryptandrus*	Common	1.0
Prairie Junegrass	*Loeleria macrantha*	Common	3.0
Hard Fescue	*Festuca brevipila*	'Durar'	3.0
SEEDING RATE POUNDS PLS/ACRE			**32.0**

3.2 Riparian and Wetland Habitat

Riparian habitat typically consists of trees and shrubs and more robust herbaceous vegetation associated with surface and ground water in or adjacent to natural drainages. Within short grass prairie ecosystems, riparian habitat increases the overall diversity of vegetation and provides valuable wildlife habitat and movement corridors for species to navigate the landscape. High bird diversity is correlated with the structural diversity provided by varied sizes of trees and shrubs. Some shrubs species provide berries for birds and mammals. Dead trees provide roosting and nesting sites for raptors and dens for terrestrial mammals such as raccoons.

Riparian vegetation communities/land cover types observed on the Site include:

Mesic Midgrass Prairie (MMP): MMP is the second largest plant community on the Site covering approximately 16.47 AC out of a total of 295 acres (5.6%). MMP along natural channels and ravines closely approximates riparian habitat on this Site but is dominated by grassland versus trees and shrubs, and grassland found along major perennial creeks and rivers.

MMP is characterized by moist (mesic) soil conditions that support semi-native midgrass prairie species (listed above) but is more robust due to greater soil moisture. Like XMP, MMP has been affected by persistent human disturbance and prairie dog use within the northern ephemeral channel. MMP quality and cover is fair to good in non-prairie dog areas along the southern channel and its ephemeral tributaries. MMP contains occasional patches of weeds that are more robust due to greater soil moisture.

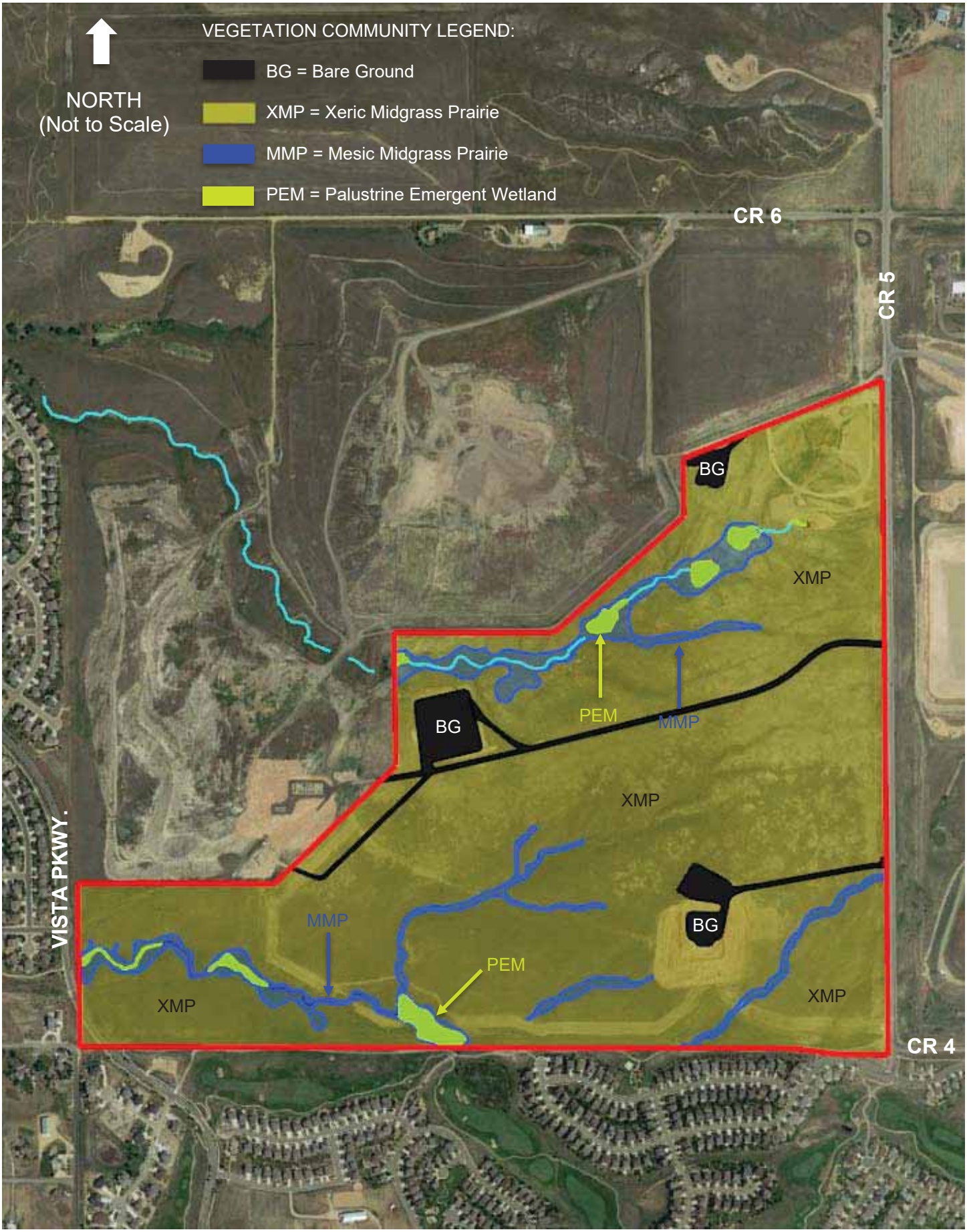
Palustrine Emergent Wetland (PEM): PEM occupies approximately 3.57 acres out of a total of 295 acres (1.2%). Out of the total, PEM in remnant stock ponds along the northern ephemeral channel consists of 1.62 acres of poor quality herbaceous wetland plants and 1.95 acres of wetland patches along the southern intermittent channel.

Wetland Vegetation is further described in the Wetland Report prepared by Alpine Ecological Resources, LLC provided in Appendix A.

Figure 3, Vegetation Map illustrates the major riparian and wetland vegetation communities noted above. Representative photos of the Site are provided in Appendix C including a photo location map.

Figure 3

VEGETATION MAP



SOURCE: Google Earth Aerial Image, 5/31/18

Figure 3 VEGETATION MAP

3.2 Native and Specimen Trees

The current Stratus development plan does not propose impacts to any existing trees on the Site. However, if plans change, all native and specimen trees were inventoried as described below, including those that are under 4-inches diameter at breast height (DBH) such that a Native and Specimen Tree Protection Plan may be prepared. Existing trees are illustrated on Figure 4, Native and Specimen Tree Map.

A total of 4 individual riparian trees (single stem and multi-stem) exist immediately off site in the lower reach of the northern ephemeral drainage immediately adjacent to the western Site boundary:

- SAL FRA – Salix fragilis (crack willow): 2” Multi-stem
- SAL FRA – Salix fragilis (crack willow): 2” Multi-stem
- SAL FRA – Salix fragilis (crack willow): 6” Multi-stem
- POP DEL – Populus deltoides (plains cottonwood): 9” Multi-stem

Two (2) dead trees exist in the upper reach of the northern ephemeral drainage adjacent to a remnant stock pond. Dead trees are potential habitat for cavity nesting birds. These trees should be checked for cavities and birds prior to removal.

A total of 9 individual riparian trees (single stem and multi-stem) exist adjacent to the southern, intermittent drainage:

- SAL FRA – Salix fragilis (crack willow): 6” Multi-stem
- ELA ANG – Elaeagnus angustifolia (Russian olive): 2”
- ELA ANG – Elaeagnus angustifolia (Russian olive): 2”
- SAL FRA – Salix fragilis (crack willow): 6” Multi-stem
- SAL FRA – Salix fragilis (crack willow): 4” Multi-stem
- SAL FRA – Salix fragilis (crack willow): 4” Multi-stem
- POP DEL – Populus deltoides (plains cottonwood): 6” Multi-stem
- SAL FRA – Salix fragilis (crack willow): 3” Multi-stem
- FRA PEN – Fraxinus pennsylvanica (green ash): 3”
- POP DEL – Populus deltoides (plains cottonwood): 9”

A total of 7 individual specimen trees (single stem) exist along the eastern side of Vista Parkway adjacent to the western edge of the Site just south of the Parkdale Circle round-about:

- MAL SN – Malus Spring Snow’ (spring snow crabapple): 3”
- QUE SPP – Quercus species (oak species): 2”
- QUE SPP – Quercus species (oak species): 2”
- ALM AME – Ulmus Americana (American elm): 3”
- AES GLA – Aesculus glabra (Ohio buckeye): 1”
- GLE TRI – Gleditsia tricanthos (Honeylocust): 2”
- MAL SN – Malus Spring Snow’ (spring snow crabapple): 3”

A total of 5 individual specimen trees (single stem) exist along the western side of Vista Parkway within the southwestern corner of the site:

- MAL SN – Malus Spring Snow’ (spring snow crabapple): 2”

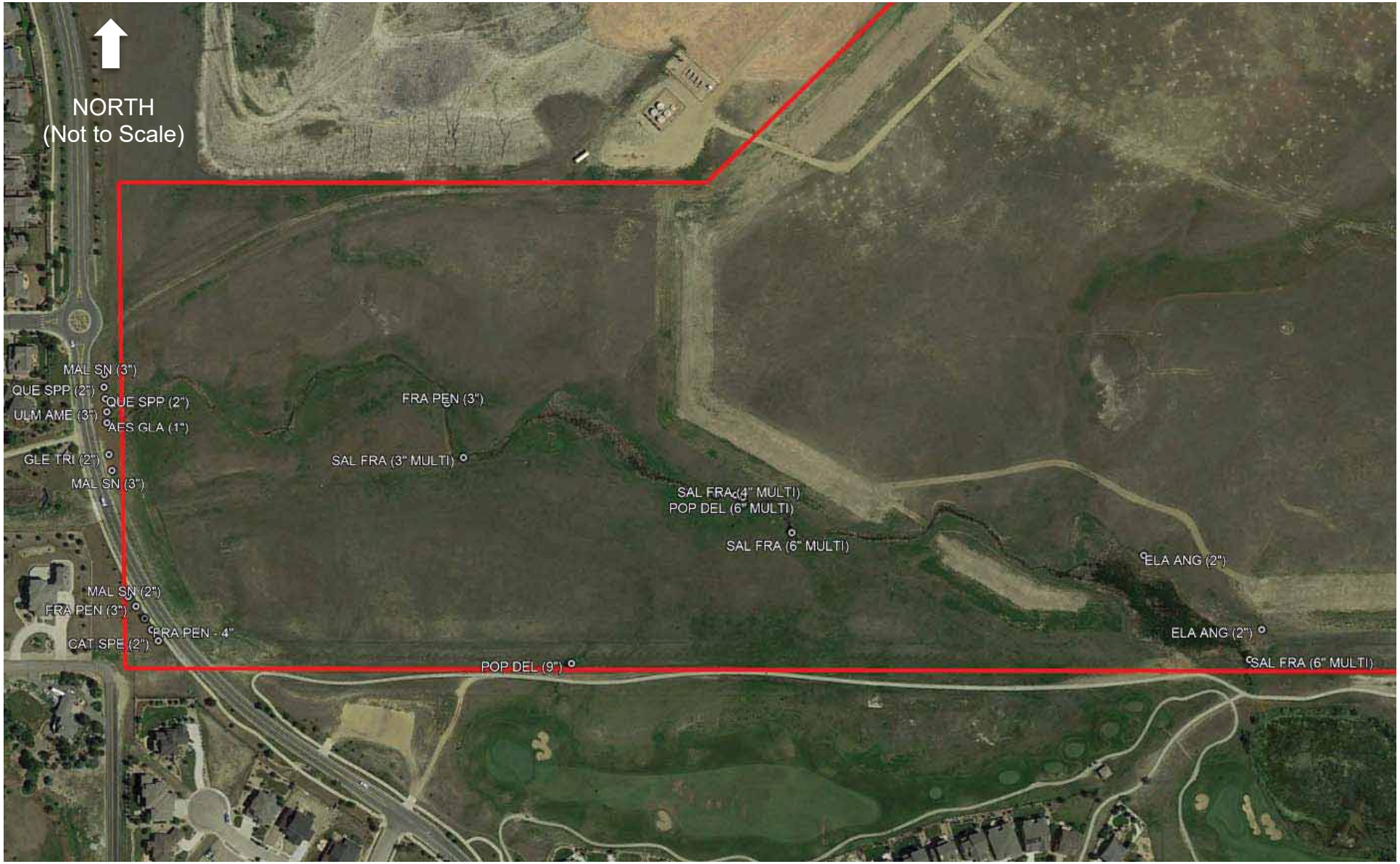
- FRA PEN – Fraxinus pennsylvanica (green ash): 3”
- FRA PEN – Fraxinus pennsylvanica (green ash): 6”
- FRA PEN – Fraxinus pennsylvanica (green ash): 4”
- CAT SPE – Catalpa speciose (Catalpa): 2”

Figure 4

NATIVE & SPECIMEN TREE MAP

SOURCE: Google Earth Aerial Image, 5/31/18

Figure 4 NATIVE & SPECIMEN TREE MAP – NORTHWEST CORNER



SOURCE: Google Earth Aerial Image, 5/31/18

Figure 4 NATIVE & SPECIMEN TREE MAP – SOUTHWEST CORNER

4.0 FLOODPLAINS, WATERS OF THE US INCLUDING WETLANDS

An unnamed ephemeral drainage with remnant stock ponds runs east to west along the north edge of the Site, herein referred to as the northern ephemeral drainage. This drainage runs into future Redtail Ranch Filing #2 in a northwesterly direction toward Coal Creek. An intermittent drainage with patches of emergent wetland runs east to west along the southwestern edge of the site beginning in Vista Ridge and exiting under a major culvert under Vista Parkway. This drainage is herein referred to as the southern intermittent drainage. Numerous ephemeral tributaries/upland ravines run into both of these drainages. Please refer to Figure 5, Wetland and Waterbodies Map.

Waters of the United States (WOUS) and wetlands are described in detail in the attached Wetland Report prepared by Alpine Ecological Resources, LLC provided in Appendix A. Ecos agrees with the data provided in this report and therefore it is incorporated herein by reference.

The USACE provided an Approved Jurisdictional Determination for Redtail Ranch (USACE File No. NOW-2015-00393-DEN) on May 11, 2015 whereby the northern ephemeral drainage was deemed non-jurisdictional. The southern intermittent drainage was deemed jurisdictional and subject to regulation under the Clean Water Act (CWA). Please refer to Appendix A. Jurisdictional Determinations (JDs) are legally valid for a period of 5 years. Stratus has requested that the USACE extend the JD for an additional 5 years.

Coal Creek is the only drainage within the vicinity of the Site that includes a FEMA mapped 100-year floodplain. The intermittent and ephemeral drainages on Site are not identified and mapped by FEMA.

Stratus development plans do not currently propose impacts to any jurisdictional waters or wetlands. If during the course of site design unavoidable impacts are found to be necessary along jurisdictional waters to install roads, trails, or utilities, Stratus will obtain a Section 404 permit.

Stratus will impact non-jurisdictional wetlands and waters in the northern ephemeral drainage to conduct necessary landfill remediation, create stormwater detention/water quality facilities, and enhance open space. This northern ephemeral drainage is of very poor quality, is not jurisdictional, not regulated under the Clean Water Act and therefore no Section 404 permit is required.

Figure 5

WETLAND AND WATER BODIES MAP

Source: Alpine Ecological Jurisdictional Delineation, May 2015

Figure 5 WETLAND & WATER BODIES MAP

5.0 STATE AND FEDERAL LISTED SPECIES

A number of species that occur in Weld County are listed as candidate, threatened or endangered by the USFWS (USFWS 2019a) and the CPW (CPW, 2019). Ecos compiled the special status species for the Site in Table 1 below based on the data sources listed above, as well as our onsite assessment. Table 1 includes all species listed by the USFWS Information for Planning on Consultation (IPAC) database provided in Appendix B. The results of the IPAC database search covers all of Weld County. Some species are included which are not expected to occur on the Site. Additional state-listed animal species are included if there is potential for them to be impacted by the Project. Ecos has provided our professional opinion regarding the probability that these species may occur within the Site and their probability of being impacted by the Project.

The likelihood that the Project would impact any federally-listed species is none to very low. Most are not expected occur in the Project area and no downstream impacts to the North Platte, South Platte and Laramie River Basins would occur. There is low to moderate potential for impacts to some State-listed species. However, there are no state-level regulatory protections for these species.

TABLE 1 - STATE AND FEDERAL PROTECTED SPECIES POTENTIALLY IMPACTED BY THE PROJECT

Species	Status	Habitat Requirements and Potential Presence	Probability of Impact by Project
FISH			
Pallid sturgeon (*Scaphirhynchus albus*)	Federal: Endangered	Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska.	None. The Site is not within species range; and the proposed project will not alter or deplete flows to the relevant river basins.
REPTILES AND AMPHIBIANS			

TABLE 1 - STATE AND FEDERAL PROTECTED SPECIES POTENTIALLY IMPACTED BY THE PROJECT			
Species	**Status**	**Habitat Requirements and Potential Presence**	**Probability of Impact by Project**
Common garter snake (*Thamnophis sirtalis*)	State: Special Concern	Occupy most wetland habitats during the summer. Hibernate during the winter in a variety of habitats. Moderate potential to occur along the margins of the unnamed tributary to Coal Creek that flows along the southern edge of the Site.	Moderate. The best summer habitat will not be directly impacted. Lower quality habitat and upland buffer areas will be impacted. Development will increase the residence time of water but could reduce water quality.
BIRDS			
Least tern (*Sternula antillarum*)	Federal: Endangered State: Endangered	Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska.	None. Does not occur on Site; and the proposed project will not alter or deplete flows to the relevant river basins.
Mexican spotted owl (*Strix occidentalis lucida*)	Federal: Threatened State: Threatened	Mature, old-growth forests of white pine, Douglas fir, and ponderosa pine; steep slopes and canyons with rocky cliffs.	None. Suitable, montane habitat is not present on Site.

TABLE 1 - STATE AND FEDERAL PROTECTED SPECIES POTENTIALLY IMPACTED BY THE PROJECT			
Species	**Status**	**Habitat Requirements and Potential Presence**	**Probability of Impact by Project**
Piping plover (*Charadrius melodus*)	Federal: Threatened State: Threatened	Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska.	None. Does not occur on Site; and the proposed project will not alter or deplete flows to the relevant river basins.
Western burrowing owl (*Athene cunicularia*)	State: Threatened	Occurs in grasslands in, or near, prairie dog towns. Typically found farther east in areas with minimal human presence.	Moderate. Numerous prairied dog burrows are present within the Site which provide potential habitat.
Whooping crane (*Grus americana*)	Federal: Endangered State: Endangered	Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska.	None. Does not occur on Site; and the proposed project will not alter or deplete flows to the relevant river basins.
MAMMALS			

TABLE 1 - STATE AND FEDERAL PROTECTED SPECIES POTENTIALLY IMPACTED BY THE PROJECT			
Species	**Status**	**Habitat Requirements and Potential Presence**	**Probability of Impact by Project**
Black-tailed prairie dog (*Cynomys ludovicianus*)	State: Special Concern	Form large colonies or "towns" in shortgrass or mixed prairie. This species occurs on Site.	High. The existing burrows are adjacent to and within the proposed limits of disturbance. Development will eradicate & reduce the options for natural dispersal.
Preble's meadow jumping mouse (*Zapus hudsonius preblei*)	Federal: Threatened State: Threatened	Inhabits well-developed riparian habitat with adjacent, relatively undisturbed grassland communities, and a nearby water source. Well-developed riparian habitat includes a dense combination of grasses, forbs and shrubs; a taller shrub and tree canopy may be present. Has been found to regularly use uplands at least as far out as 100 meters beyond the 100-year floodplain.	Very low. The closest potentially occupied habitat is 8 miles southwest of the Site; and the closest USFWS designated critical habitat is 9.5 miles southwest of the Site. Additionally, all USFWS trapping data within a 6-mile radius of the Site indicate “Trapped Not Found”, therefore it is not expected to occur.

TABLE 1 - STATE AND FEDERAL PROTECTED SPECIES POTENTIALLY IMPACTED BY THE PROJECT			
Species	**Status**	**Habitat Requirements and Potential Presence**	**Probability of Impact by Project**
PLANTS			
Colorado butterfly plant (*Oenothera coloradensis*)	Federal: Recently Delisted (published11/5/19 at 84 FR 59570, effective 12/5/19)	Typically occur in flat, sunny areas within the transitional hydrologic zone between wetlands and uplands.	None. Only known from one location in Colorado, therefore not expected to occur on Site. This species was recently delisted under the ESA
Ute ladies'-tresses orchid (*Spiranthes diluvialis*)	Federal: Threatened	Primarily occurs along seasonally flooded river terraces, sub-irrigated or spring-fed abandoned stream channels or valleys, and lakeshores. May also occur along irrigation canals, berms, levees, irrigated meadows, excavated gravel pits, roadside borrow pits, reservoirs, and other human-modified wetlands. Prefers open habitats with generally low vegetation.	None. Suitable habitat does not occur on Site.
Western prairie fringed orchid (*Platanthera praeclara*)	Federal: Threatened	Occurs in tallgrass prairie in Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and Oklahoma. Upstream depletions to the Platte River system in Colorado and Wyoming may affect the species in Nebraska. Site is not within species range.	None. Site is not within species range; and the proposed project will not alter or deplete flows to the relevant river basins.

6.0 RAPTORS AND MIGRATORY BIRDS

Raptors and most birds are protected by the Colorado Nongame Wildlife Regulations, as well as by the federal Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA). The COGCC GIS database did not show any active raptor nests within one mile of the Site.

Any tree, shrub, patch of shrubs, undisturbed grassland, or prairie dog colony on or adjacent to the site can provide potential nesting habitat for resident or migratory raptors or songbirds. Riparian and wetland habitat along channels and occasional trees therein can provide valuable nesting habitat for resident and migrating songbirds and waterfowl.

Suitable habitat for ground nesting birds is present on Site in undisturbed grassland areas. Prairie dog colonies on Site that cover approximately 152.75 acres of the Site (52%) provide suitable habitat for burrowing owl and abundant prey for transient eagles and raptors. Great horned owl were observed perching in cottonwood trees at the downstream end of the northern drainage. However, no raptor or songbird nests were observed on the Site during the inspection.

The development plan being prepared by Stratus will preserve existing trees and a grassland buffer along the main threads of the northern and southern drainages. In addition, native tree and shrub planting and grassland restoration and management in proposed open space will improve the health of potential habitat for raptors and songbirds. Increased runoff captured and detained in stormwater detention ponds and released downstream will improve the vitality of riparian habitat along the channels on site as well as downstream areas.

Please refer to Figure 4, Native and Specimen Tree Map for locations of trees that may provide potential habitat for raptors and migratory birds.

7.0 SIGNIFICANT WILDLIFE HABITAT AND CORRIDORS

The Town of Erie Development and Design Standards state that applicants should give priority to the preservation of significant natural features including wetlands, natural drainage ways, bodies of water, significant wildlife corridors and habitat, and sites with federally- or state-recognized endangered species.

Weedy and disturbed, midgrass prairie occupied by prairie dog is potential habitat for fox, coyotes, and burrowing owl when they migrate and temporarily reside in Colorado (roughly between May 1st and October 31st). Prairie dog colonies are also a source of abundant prey for raptors. Undisturbed grassland habitat provides habitat for ground nesting birds such as meadow lark and ferruginous hawk. The natural ephemeral and intermittent drainages running across the site provide corridors in which numerous mammals such as coyote, fox, rodents, deer and other large mammals can forage and move through the landscape and connect to other corridors such as the Coal Creek corridor to the west that allow animals to connect to the regional landscape. Riparian and wetland habitat provide good habitat for many species of wildlife and provide numerous functions, values and benefits to Erie residents.

The development plan being prepared by Stratus will preserve the lower part of the southern intermittent drainage and adjacent grassland buffer for open space and trail corridors. The northern ephemeral drainage will be improved for stormwater detention and conveyance facilities, open space and trail corridors. Some prairie dog habitat will be preserved in proposed open space adjacent to these corridors, however the majority of it will be eradicated and covered by development.

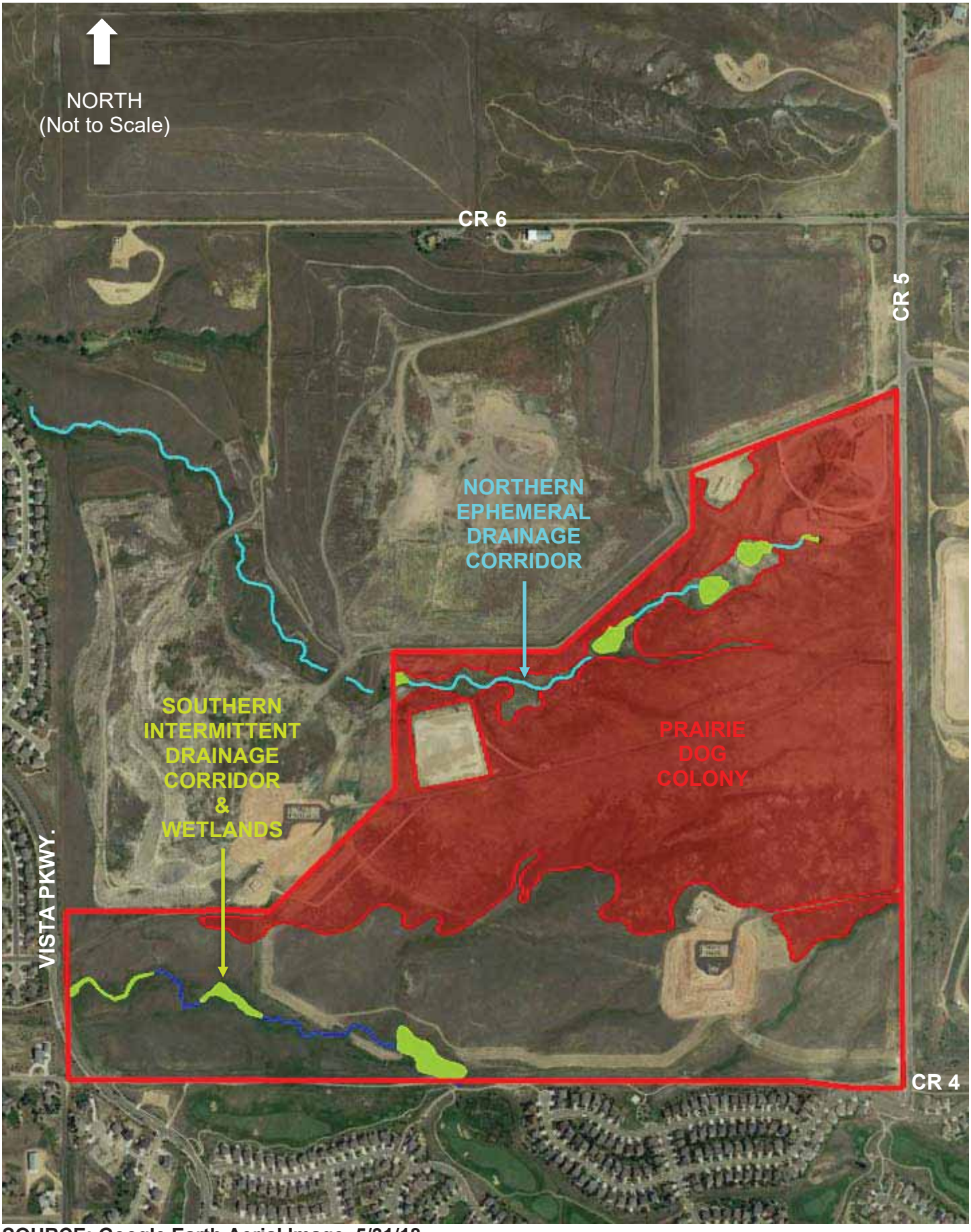
Please refer to Figure 6, Significant Wildlife Habitat and Corridors Map that illustrate the location and extent of prairie dog colonies, wetlands, natural drainage ways, and bodies of water that may be considered significant wildlife habitat and corridors.

8.0 ARCHAEOLOGICAL & HISTORICAL & RESOURCES

Ecos contacted the State of Colorado Office of Archaeology and Historic Preservation (OAHP) to conduct a file search of the Colorado Inventory of Cultural Resources. The OAHP provided a letter stating that 3 sites and 4 surveys were located and performed in Section 29, the section where the Site is located. Refer to Appendix D, Office of Archaeology and Historic Preservation (OAHP) Letter. All sites listed, including a segment of the Burlington Northern Railroad are not officially eligible for preservation. No mapping of any listed sites was provided by the OAHP.

Figure 6

SIGNIFICANT WILDLIFE HABITAT & CORRIDORS MAP



SOURCE: Google Earth Aerial Image, 5/31/18

Figure 6 SIGNIFICANT WILDLIFE HABITAT & CORRIDORS MAP

9.0 REGULATORY RECOMMENDATIONS

9.1 Clean Water Act

Section 404 of the Clean Water Act prohibits the discharge of dredged or fill material into jurisdictional waters of the U.S. (including wetland habitat) protected by the Act without a valid permit. The Alpine-Eco Wetland report and Approved Jurisdictional Determination provided by the USACE identified jurisdictional and non-jurisdictional Waters of the US, including wetlands on the Site. If the jurisdictional areas were to be impacted, then a Section 404 permit would be required, and the developer must coordinate with the U.S. Army Corps of Engineers prior to implementation of said impacts.

Clarification of Jurisdictional vs. Non-Jurisdictional Waters of the U.S.

In 2008 the USACE and U.S. Environmental Protection Agency (EPA) prepared a guidance memorandum, *Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in Rapanos v. United States & Carabell v. United States*. This memorandum provides guidance to EPA regions and USACE districts implementing the Supreme Court's decision in the consolidated Rapanos and Carabell cases which address the jurisdiction over waters of the United States under the Clean Water Act. The key points of the memorandum, which apply to the Jurisdictional Determination made by the USACE are summarized below:

The agencies will assert jurisdiction over the following waters:

- Traditional navigable waters;
- Wetlands adjacent to traditional navigable waters;
- Non-navigable tributaries of traditional navigable waters that are relatively permanent where the tributaries typically flow year-round or have continuous flow at least seasonally (e.g., typically three months); and
- Wetlands that directly abut such tributaries.

The agencies generally will not assert jurisdiction over the following features:

- Ephemeral channels, swales or erosional features (e.g., upland ravines, gullies, small washes characterized by low volume, infrequent, or short duration flow); and
- Ditches (including roadside ditches) excavated wholly in and draining only uplands and that do not carry a relatively permanent flow of water.

The guidance above was memorialized in 2015 via the Clean Water Rule issued by the Obama Administration. However, the Trump Administration has reviewed the 2015 Clean Water Rule and after December 23, 2019, has decided to implement pre-2015 guidance under a revised Clean Water Rule. The northern ephemeral drainage with man-made stock ponds and man-induced wetlands in the landfill cap area would still be considered non-jurisdictional. The southern, intermittent drainage proposed to be preserved in open space will likely still be jurisdictional and require a 404 permit if any impacts were proposed.

9.2 Endangered Species Act

The Site is not located within any officially designated occupied or critical habitat for federally designated threatened or endangered species, including the Preble's meadow jumping mouse; nor are any federally-listed species expected to occur on Site. However, if a Section 404 permit is required then the USACE must comply with the Endangered

Species Act. This would likely be limited to including a written summary of federally-listed species, similar to the information summarized in Table 1 above.

9.3 Migratory Bird Treaty Act & Bald and Golden Eagle Protection Act

There is good habitat for ground nesting birds, several small trees along the north and south drainages that could provide nesting and cavity habitat; and potential for burrowing owls to nest within prairie dog colonies. Impacts to native birds, including their eggs, are prohibited by the MBTA and BGEPA. In Colorado, most species of birds nest between April and August and a 50 to 100-foot buffer is usually sufficient to prevent nest abandonment. Raptors may nest much earlier and have larger CPW recommended buffers to avoid impacting nests. While no raptor nests were observed on the Site, it is possible that they could build nests immediately prior to site construction. Burrowing owl nesting restrictions begin in mid-March and have a CPW recommended buffer zone of 150 feet, as well as a recommended series of three surveys prior to construction, prairie dog eradication, or other disturbance. Please note the owls are protected under the MBTA and as such the CPW recommendations are warranted and should be implemented as necessary. If possible, initial Site clearing and grubbing should be completed between September and January, which is outside of the nesting season for all species except eagles. If construction would occur in any vegetated areas between April and August, vegetation should be mowed beginning in April and kept below six inches in height to keep birds from nesting. Ecos recommends a nesting bird inventory, including a burrowing owl survey 1 to 2 weeks prior to construction to identify any new nests or presence of burrowing owl within the Site or within the CPW recommended buffers of the Site.

10.0 REFERENCES

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Appendix A

Alpine Ecological Resources Wetland Report

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Approved Jurisdictional Determination

Alpine Ecological Resources, LLC

Wetland Delineation Report

330-Acre Property
Weld County, Colorado

Prepared for: Cardno ATC
October 23, 2014

Andy Herb, Ecologist/Owner
1127 Adams Street
Denver, CO 80206

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1.0 Introduction

1.1 Purpose of This Report

The purpose of this report is to formally document the wetlands and other water features present in the study area. The primary reason for this documentation is to assist with project planning and design, which is intended to maximize avoidance of these features wherever practicable. The wetland and other water features described in this report include all those present, not just those that may be considered jurisdictional under Section 404 of the Clean Water Act.

1.2 Project Description

The current plan is to develop the property in a way that integrates residential areas within an extensive open space, parks and trails system, and a network of public streets. The proposed uses include single-family detached front-loaded homes of varying lot sizes in addition to single-family attached front-loaded homes. The current plan includes generous open space buffers to the north and east where landfills exist, and an extension of County Road 4 through the site, designed as a collector to improve the road system. The proposed density is 2.2 dwelling units per acre, but they will be clustered to preserve more than a third of the site as open space or developed park land.

2.0 Site Description

The 330-acre study area is in Weld County, approximately 2 miles southeast of the town of Erie, Colorado (**Figure 1**). It is immediately northwest of the intersection of County Road (CR) 4 and CR 5. It can be located on the United States Geological Survey (USGS) 7.5-minute series Erie, Colorado quadrangle and has the following coordinates (datum is NAD 83):

- Township 1 North, Range 68 W, Section 29
- Universal Transversal Mercator (UTM): 13 497789E, 4429915N
- Latitude/Longitude: 40.0194°N, 105.0259°W

The study area is approximately 4,600 feet above mean sea level and is flanked by residential development and a golf course on the south, residential development on the west, and landfills on the north and east. The site consists of rolling hills dominated by disturbed grasslands. The only current land use observed is oil and gas production; several wells are present in and adjacent to the study area. There are two unnamed tributaries to Coal Creek flowing through the site and the hydrologic unit code (HUC) is 10190005 (St. Vrain).

The site is located near the interface of the Front Range Fans and the Flat to Rolling Plains portions of the High Plains Ecoregion (EPA 2014). It is more typical of the Flat to Rolling Plains which is characterized by flat to rolling plains with intermittent streams situated between 3,600 and 5,700 feet above mean sea level. Typical vegetation for this part of the ecoregion is shortgrass prairie with riparian areas dominated by cottonwoods (*Populus* spp.), shrubs, and herbaceous vegetation. Typical land use is mostly dryland and irrigated cropland, grazing, oil and gas production, and some grassland.

The site is also in the Western Great Plains Range and Irrigated Land Resource Region (NRCS 2006). This Land Resource Region is delineated by the western edge of the Great Plains, abutting the foothills of the Rocky Mountains. The primary resource concerns in this region are overgrazing, wind and water erosion, invasive vegetation, and surface water quality.

3.0 Methods

3.1 Literature Review

Prior to conducting the field survey, numerous sources of data were reviewed to gain a general understanding of the ecology of the study area. These sources included National Wetlands Inventory (NWI) maps, aerial photographs, topographic maps, soil survey, local and federal regulatory agency websites, and other relevant data.

3.2 Field Data Collection

Andy Herb (senior ecologist) surveyed the entire study area on September 12, 13, and 16, 2014 to identify wetlands and other water features. These features were delineated within the defined study area using procedures outlined in the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region* (Corps 2010). This involved a detailed examination of plants, soils, and hydrologic indicators present.

Generally, the detailed examination of each wetland involves the collection of vegetation, soil, and hydrology data at paired data points. These paired points include one point within the suspected wetland and one point in the adjacent upland. However, if numerous wetlands are in close proximity and surrounded by the same or similar upland plant community, then upland data points of nearby sites are often utilized, rather than creating a new upland data point for each wetland area.

All plants considered dominant in wetlands, as well as other commonly observed species, were identified and are listed in this report. During field examinations, a list of dominant plants was documented for each potential wetland area and was compared to the *National Wetland Plant List* (NWPL) (Corps 2014) to determine the "wetland indicator status" of each species. Generally, if at least 50 percent of those species had an indicator status of facultative (FAC) or wetter, the potential wetland area would satisfy the US Army Corps of Engineers (Corps) criterion for wetland vegetation. The botanical nomenclature presented in this report follows the NWPL. If a species is not listed in the NWPL, then the nomenclature follows the PLANTS Database (NRCS 2014).

Soils were examined at various locations throughout the study area to identify the presence of hydric soil indicators. If indicators were found, multiple pits may have been dug along the gradient to identify the extent of hydric soils.

While recording plant species and identifying soil characteristics, potential wetlands within the study area were assessed for evidence and potential sources of wetland hydrology. This evidence included primary indicators such as the presence of surface water and saturation, and secondary indicators including surface soil cracks and drainage patterns.

Most surrounding uplands were not formally sampled or recorded on data forms, and were generally examined while attempting to identify wetland areas. Those uplands examined in more detail or recorded on data forms typically exhibited evidence of at least one wetland indicator (hydrophytic vegetation, hydric soils, or wetland hydrology). Data collected for all areas investigated and deemed non-wetland are not necessarily included in this report.

3.3 Mapping

After determining the approximate extent of the wetlands based on the presence of hydric soils, hydrophytic vegetation, and wetland hydrology, the wetland boundary was flagged and recorded using survey equipment. This equipment generally provides accuracy to within one or two centimeters.

3.4 Wetland Classification

Wetlands in the study area were classified in accordance with the *Hydrogeomorphic Method* (HGM) (Brinson 1993) and the *Classification of Wetlands and Deep Water Habitats of the United States* (Cowardin, et al. 1979).

There are two HGM classifications applicable to the wetlands in the study area, including riverine and depressional. Riverine wetlands are those that are associated with a stream channel, floodplain, or terrace and primarily supported by overbank flows or shallow subsurface flow associated with the channel. Depressional wetlands are those that are situated in topographic depressions that do not contain permanent water deeper than 6.6 feet.

The Cowardin classification scheme includes only one wetland type that applies to wetlands in the study area: palustrine emergent (PEM). PEM wetlands are those dominated by herbaceous vegetation (grasses, grass-likes, and forbs).

3.5 Wetland Functional Assessment

Wetland functions were generally assessed using the concepts presented in the *Functional Assessment of Colorado Wetlands (FACWet) Method* (Johnson, et al. 2013), although a complete assessment was not conducted. FACWet is a rapid assessment method that provides a reliable and consistent approach to rating the condition of wetlands relative to their natural potential by focusing on the presence of stressors. Stressors are human-caused changes to a wetland or adjacent lands that alter a wetland's ability to perform ecological functions and processes.

3.6 Jurisdictional Status

The jurisdictional status of wetlands and other water features is generally based on the *US Army Corps of Engineers Jurisdictional Determination Form Instructional Guidebook* (Corps 2007) and other Corps documents (Corps 2008). In order for an aquatic feature to be considered a "water of the US" and jurisdictional under Section 404 of the Clean Water Act, it must be at least one of the following:

- A traditional navigable water (TNW)
- A wetland adjacent to a TNW
- A relatively permanent water (RPW), including tributaries that typically flow year-round or have a continuous flow at least seasonally, typically three months
- A wetland that directly abuts a RPW
- A wetland adjacent to a RPW, but only if it can be shown that the feature has a "significant nexus" with a TNW

- A non-RPW or wetland adjacent to a non-RPW, if the feature has a "significant nexus" with a TNW

The significant nexus evaluation includes an assessment of the flow characteristics and functions of the feature to see if it has "more than an insubstantial or speculative effect on the chemical, physical, or biological integrity of TNWs (Corps 2007)." If it does, then it is considered jurisdictional.

4.0 Wetlands

The study area contains four individual wetland areas encompassing a total of 2.85 acres (Wetlands A through D). All of these wetlands are associated with unnamed tributaries to Coal Creek, which is located approximately 0.5 mile west of the study area. The wetlands are listed in **Table 1**, shown on **Figure 2**, and briefly described in the following sections. Wetland Determination Data Forms for all the wetlands are in **Appendix A** and photos are in **Appendix B**.

Wetland A is expected to be considered jurisdictional under Section 404 of the Clean Water Act as a result of connections to Coal Creek, which is likely considered a RPW. Wetlands B, C, and D appear to be hydrologically isolated, with no connection to or significant nexus with Coal Creek, or other RPWs or TNWs.

Table 1: Wetlands in the Study Area

Wetland	Cowardin Classification	HGM Classification	Area (acres)	Notes
South Unnamed Tributary				
Wetland A	PEM	Riverine	2.41	Wetlands in and along a small channel
North Unnamed Tributary				
Wetland B	PEM	Depressional	0.30	Wetland fringe around old pond with non-wetland spring and channel
Wetland C	PEM	Depressional	0.13	Wetland fringe around old pond
Wetland D	PEM	Depressional	<0.01	Small wetland below dam of old pond
		Total	**2.85**	

4.1 General Description

South Unnamed Tributary Wetlands: The South Unnamed Tributary contains one wetland (Wetland A). This wetland runs through the southwest portion of the study area and carries water from east to west. It is the largest wetland in the study area and generally consists of PEM fringe along both sides of a narrow and shallow channel (**Photos 1—9 in Appendix B**). In some areas, especially in the upper portion of the tributary, the wetlands fill the entire channel (from bank to bank). In other areas, especially in the middle reach, the fringe is discontinuous and very narrow (1 to 3 feet wide) as a result of channel degradation (down-cutting). The soils along the tributary are generally very thick clay, which was evident in some of the exposed banks.

Adjacent areas are generally very weedy and previously disturbed, presumably by historic agriculture or grazing activities. There is a golf course and dense residential development along the tributary immediately upstream of the study area, including a man-made pond.

North Unnamed Tributary Wetlands: The North Unnamed Tributary contains three wetlands (Wetlands B, C and D) and all are associated with man-made ponds (see *Section 5.0 Other Water Features*). The drainage runs through the north portion of the study area and carries water from east to west. There is a spring upstream of the ponds that appears to discharge water seasonally (**Photo 16 in Appendix B**). Wetlands B and C consist of PEM wetland fringes around open water in the ponds, and Wetland D is a very small PEM wetland at the base of the lowest of the three dams (**Photos 10—15 in Appendix B**). There is a fourth old pond at the downstream end of the tributary, but it doesn't contain water at enough frequency or duration to be considered a wetland or other water feature.

Adjacent areas are similar to that of the South Unnamed Tributary and are generally very weedy and previously disturbed, presumably by historic agriculture or grazing activities. This tributary has a landfill both upstream and downstream of the study area, leaving this reach disconnected from the rest of the tributary.

4.2 Vegetation

All of the wetlands in the study area are classified as PEM. A list of the most common plant species observed in and near the wetlands is provided in **Table 2**. A brief discussion of the vegetation in the different wetland areas follows the table. More information can be found on the data forms in **Appendix A**.

Table 2: Common Plants Found In and Near Wetlands in the Study Area

Common Name	Scientific Name[1]	Indicator Status[2]
Woody Plants		
Russian olive	*Elaeagnus angustifolia*	FACU
Rubber rabbitbrush	*Ericameria nauseosus*	UPL
Green ash	*Fraxinus pennslyvanica*	FAC
Plains cottonwood	*Populus deltoides*	FAC
Golden currant	*Ribes aureum*	FACU
Peachleaf willow	*Salix amygdaloides*	FACW
Narrowleaf willow	*Salix exigua*	OBL
Five stamen tamarisk	*Tamarix chinensis*	FACW
Herbaceous Plants		
Crested wheatgrass	*Agropyron cristatum*	UPL
Showy milkweed	*Asclepias speciosa*	FAC
Haldberdleaf orache	*Atriplex patula*	FACW
Mexican fireweed	*Bassia scoparia*	FACU
Devil's pitchfork	*Bidens frondosa*	FACW
Smooth brome	*Bromus inermis*	UPL
Cheatgrass	*Bromus tectorum*	UPL
Clustered field sedge	*Carex praegracilis*	FACW
Canadian thistle	*Cirsium arvense*	FACU
Field bindweed	*Convolvulus arvensis*	UPL
Canadian horseweed	*Conyza canadensis*	UPL
Golden tickseed	*Coreopsis tinctoria*	FAC
Large barnyard grass	*Echinochloa crus-galli*	FAC
Common spikerush	*Eleocharis palustris*	OBL
Slender wildrye	*Elymus trachycaulus*	FACU
Creeping wildrye	*Elymus repens*	FACU
Fringed willowherb	*Epilobium ciliatum*	FACW
Velvetweed	*Gaura parviflora*	UPL
American licorice	*Glcyrrhiza lepidota*	FACU
Common sunflower	*Helianthus annuus*	FACU
Foxtail barley	*Hordeum jubatum*	FACW
Deer root	*Iva axillaris*	FAC
Baltic rush	*Juncus balticus*	FACW
Lesser poverty rush	*Juncus tenuis*	FAC
Prickly lettuce	*Lactuca serriola*	FAC
Yellow sweetclover	*Melilotus officinalis*	FACU
Hairy evening primrose	*Oenothera villosa*	FACU
Common panic grass	*Panicum capillare*	FAC
Wand panic grass	*Panicum virgatum*	FAC
Western wheatgrass	*Pascopyrum smithii*	FACU
Dockleaf smartweed	*Persicaria lapathifolia*	OBL

Common Name	Scientific Name[1]	Indicator Status[2]
Reed canarygrass	*Phalaris arundinacea*	FACW
Great plantain	*Plantago major*	FAC
Kentucky bluegrass	*Poa pratensis*	FACU
Yard knotweed	*Polygonum aviculare*	FACU
Annual rabbitfoot grass	*Polypogon monspeliensis*	FACW
Curly dock	*Rumex crispus*	FAC
Saltmarsh club rush	*Schoenoplectus maritimus*	OBL
Softstem clubrush	*Schoenoplectus tabernaemontani*	OBL
Cutleaf nightshade	*Solanum triflorum*	UPL
Tall goldenrod	*Solidago altissima*	FACU
Spinyleaf sowthistle	*Sonchus asper*	FAC
White heath American aster	*Symphyotrichum ericoides*	FACU
Common dandelion	*Taraxacum officinale*	FACU
Field pennycress	*Thlaspi arvense*	FACU
Narrowleaf cattail	*Typha angustifolia*	OBL
Broadleaf cattail	*Typha latifolia*	OBL
Carpet vervain	*Verbena bracteata*	FACU
Blue water speedwell	*Veronica anagallis-aquatica*	OBL
Rough cocklebur	*Xanthium strumarium*	FAC

[1] Nomenclature presented in this table follows the National Wetland Plant List (Corps 2014); if the species is not listed then nomenclature follows the PLANTS database (NRCS 2014).
[2] Indicator status is from the National Wetland Plant List (Corps 2014): OBL = obligate wetland species, >99% probability of occurring in a wetland; FACW = facultative wetland species, 67-99% probability of occurring in a wetland; FAC = facultative species, 34-66% probability of occurring in a wetland; FACU = facultative upland species, <33% probability of occurring in a wetland; and UPL = <1% probability of occurring in a wetland. If the species is not included in the National Wetland Plant List then the indicator status is assumed to be UPL.

South Unnamed Tributary Wetlands: By far the most dominant plant in Wetland A is cattail (*Typha* spp.). The other most common herbaceous plants found in the wetlands are softstem clubrush, curly dock, dockleaf smartweed, and common spikerush. There is one large pocket of narrowleaf willow at the downstream end of the tributary but otherwise, woody vegetation is very widely scattered and consists of a few young plains cottonwood and peachleaf willow.

The wetland boundary is very distinct in most areas as a result of abrupt changes in topography. It generally consists of a transition from drier wetland plants like dockleaf smartweed, curly dock, and halberdleaf orache to mesic (but upland) species like Canadian thistle, Kentucky bluegrass, creeping wildrye, yellow sweetclover, and slender wildrye.

North Unnamed Tributary Wetlands: Similar to Wetland A, the wetlands in the North Unnamed Tributary are almost exclusively dominated by cattail and the wetland boundary is very distinct in most areas as a result of abrupt changes in topography. The boundary generally consists of a transition from dense cattail to sparse cattail with drier wetland plants like peachleaf willow and plains cottonwood saplings, curly dock, and deer root.

4.3 Hydrology

South Unnamed Tributary Wetlands: The wetland hydrology for Wetland A is provided by surface flows in the tributary and capillary action associated with shallow groundwater. Surface flows have likely increased in recent years as the watershed has become more developed (mainly residential). These flows are likely seasonal or related to precipitation events, and probably not perennial. Flows were high during the field survey as a result of recent rains. Evidence of very high flows were observed, including rafted debris as much as 3 feet above the low flow channel elevation. These flows were likely present in September 2013 when widespread flooding occurred between Denver and Fort Collins.

Wetland hydrology indicators observed in Wetland A include: Surface Water (A1), High Water Table (A2), Saturation (A3), Drift Deposits (B3), and Geomorphic Position (D2). Wetland A is a tributary to Coal Creek, which is a perennial tributary to Boulder Creek and an RPW.

North Unnamed Tributary Wetlands: The wetland hydrology for Wetlands B, C, and D is provided by surface flows in the tributary, including discharge from the seasonal spring at the upper end of Wetland B and capillary action associated with shallow groundwater. Flows in this tributary (and probably the spring) have likely been altered by the presence of the landfill in the upper reaches of the watershed. Flows appear to be seasonal or related to precipitation events, and not perennial. Although no flows were observed during the field visit, each of the ponds associated with the wetlands contained water 0.5 to 2+ feet deep, and standing water was observed in these areas on the 2013 aerial photo.

Wetland hydrology indicators observed in the North Unnamed Tributary Wetlands include: Surface Water (A1), Saturation (A3), Surface Soil Cracks (B6), Salt Crust (B11), Hydrogen Sulfide Odor (C1), Crayfish Burrows (C8), Inundation Visible on Aerial Imagery (C9), and Geomorphic Position (D2). Wetlands B, C, and D appear to be hydrologically isolated as a result of the landfill downstream of the study area.

4.4 Soils

According to the Web Soil Survey (NRCS 2014a), the most common mapped soils in the study area are (in descending order): Midway-Shingle Complex, Ulm clay loam, Colombo clay loam, Renohill clay loam, and Wiley-Colby Complex. None of these soils or their minor components are listed as hydric.

South Unnamed Tributary Wetlands: The soils in the vicinity of the South Unnamed Tributary are all mapped as Colombo clay loam (NRCS 2014a). This soil is found on floodplains and terraces, and is derived from stratified calcareous alluvium. It is generally well-drained and has a normal depth to water table of more than 80 inches. The typical profile includes clay loam to 14 inches; stratified loam and clay loam between 14 and 21 inches; and stratified sand, loam, and clay loam between 21 and 60 inches.

Soil pits excavated in and near Wetland A (SP-A1, A2, and A3) generally confirmed the mapped soil type, revealing silty clay to a depth of about 18 inches. The hydric soil indicator observed in the wetland soil pit was Depleted Matrix (F3).

North Unnamed Tributary Wetlands: The soils in the vicinity of the North Unnamed Tributary are part of the Midway-Shingle Complex (NRCS 2014a). The complex includes 50 percent Midway and similar soils, 35 percent Shingle and similar soils, and 15 percent other minor components. Both Midway and Shingle soils are found on ridges and hills, and are derived from calcareous residuum weathered from shale. Both are well-drained and have a normal depth to water table of more than 80 inches. The typically profile of Midway is clay to a depth of 13 inches and weathered bedrock between 13 and 17 inches. Shingle has a typical profile of loam to 6 inches, clay loam between 6 and 18 inches, and unweathered bedrock from 18 to 22 inches.

Soil pits excavated in and near Wetland B (SP-B1 and B2) generally confirmed the mapped soil type, revealing silty clay to a depth of about 18 inches. The hydric soil indicators observed in the wetland soil pit were Hydrogen Sulfide (A4) and Depleted Matrix (F3).

4.5 Wetland Functions

Based on the concepts presented in the FACWet Method (Johnson, et al. 2013), the primary functions provided by the wetlands in the study area are support of wildlife habitat and sediment retention. These functions are a result of the wetlands generally having a relatively dense vegetation community along a channel, surrounded by relatively undeveloped lands. The most common stressors to the wetlands include presence of development in the watershed; severe alteration of the water source and water distribution associated with nearby development (including the golf course, residential areas, and landfills) and the multiple dams; channel incision/entrenchment; and overall soil disturbances (dams, excavations, etc.).

A complete assessment of the wetlands using FACWet will be required prior to permitting if wetland impacts exceed 0.5 acre or an Individual Section 404 permit is required.

5.0 Other Water Features

There are five other water features in the study area, including one channel associated with the South Unnamed Tributary, and three ponds and a channel associated with the North Unnamed Tributary. A summary of these features is provided in **Table 3** and they are shown on **Figure 2**.

The only other water feature expected to be jurisdictional under Section 404 of the Clean Water Act is the channel of the South Unnamed Tributary, since it is connected to Coal Creek which is likely a RPW. The other features are hydrologically isolated as a result of the landfill.

Table 3: Other Water Features in the Study Area

Feature	Area (acres)	Length (feet)	Notes
South Unnamed Tributary	-	3,066	Main channel
North Unnamed Tributary	-	320	Channel from seasonal spring to Pond B
Pond B	0.16	-	Pond associated with Wetland B
Pond C	0.34	-	Pond associated with Wetland C
Pond D	0.53	-	Pond associated with Wetland D
Total	**1.03**	**3,386**	

South Unnamed Tributary Water Features: The only other water feature associated with the South Unnamed Tributary is the channel of the tributary itself (**Photos 2—5, and 9 in Appendix B**). It appears to be intermittent or ephemeral. The channel averages approximately 3 feet wide in most areas and generally has a clay/silt bottom. The upper reach of the channel is relatively flat and shallow, with the channel banks less than 2 feet tall. The middle and lower reaches are generally much more incised, with bank heights from 2 to 4 feet. Wetlands (Wetland A) are present along most of the channel length, except for parts of the middle reach where it is the most incised. The channel enters the study area through a culvert from the golf course, carries flows east to west, and flows out of the study area through large box culverts to its confluence with Coal Creek approximately 0.5 mile to the west.

North Unnamed Tributary Water Features: There are four other water features present in the North Unnamed Tributary, including three ponds and one channel below the seasonal spring (**Photos 10—17 in Appendix B**). All of the ponds (Ponds B, C, and D) are associated with the corresponding wetlands and appear to be hydrologically isolated as a result of the landfill downstream of the study area. They are all man-made and vary in depth. Depth of water during the field visit varied from 6 inches to approximately 3 feet. The ponds appear to be intermittent or ephemeral, and likely only fill with water seasonally or after major precipitation events. Ponds B and C appear to

be more regularly wet than Pond D. This is likely because they capture the surface flows first and only those flows big enough to spill out of Pond C make it to Pond D.

The channel in this tributary connects the seasonal spring to Pond B and is intermittent or ephemeral. There are substantial salt deposits present at the spring, along the flatter parts of the channel, and in Pond B (**Photos 16 and 17 in Appendix B**), indicating the evaporation of standing water. The channel has a clay bottom and is very narrow, with an average width of around 2 feet. It flows from east to west and terminates in Pond B.

There is a fourth old pond at the downstream end of the North Unnamed Tributary, but it does not hold water at a frequency or duration enough to be considered a water feature and has not been included.

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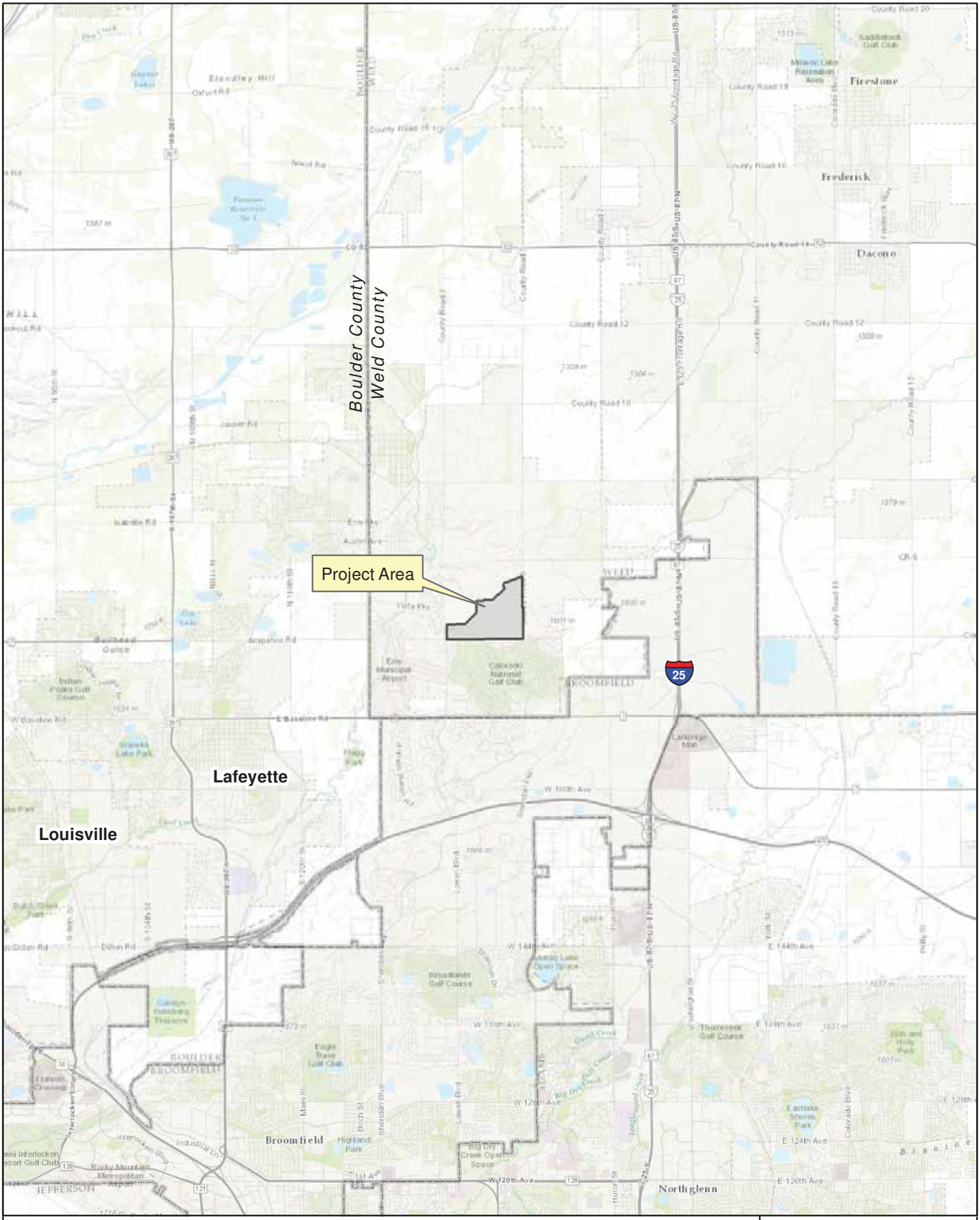


AlpineEco

N

0 0.5 1 2 3 Miles

10/09/2014

Weld County 330 Acres

Figure 1
Location Map

AlpineEco

10/10/2014

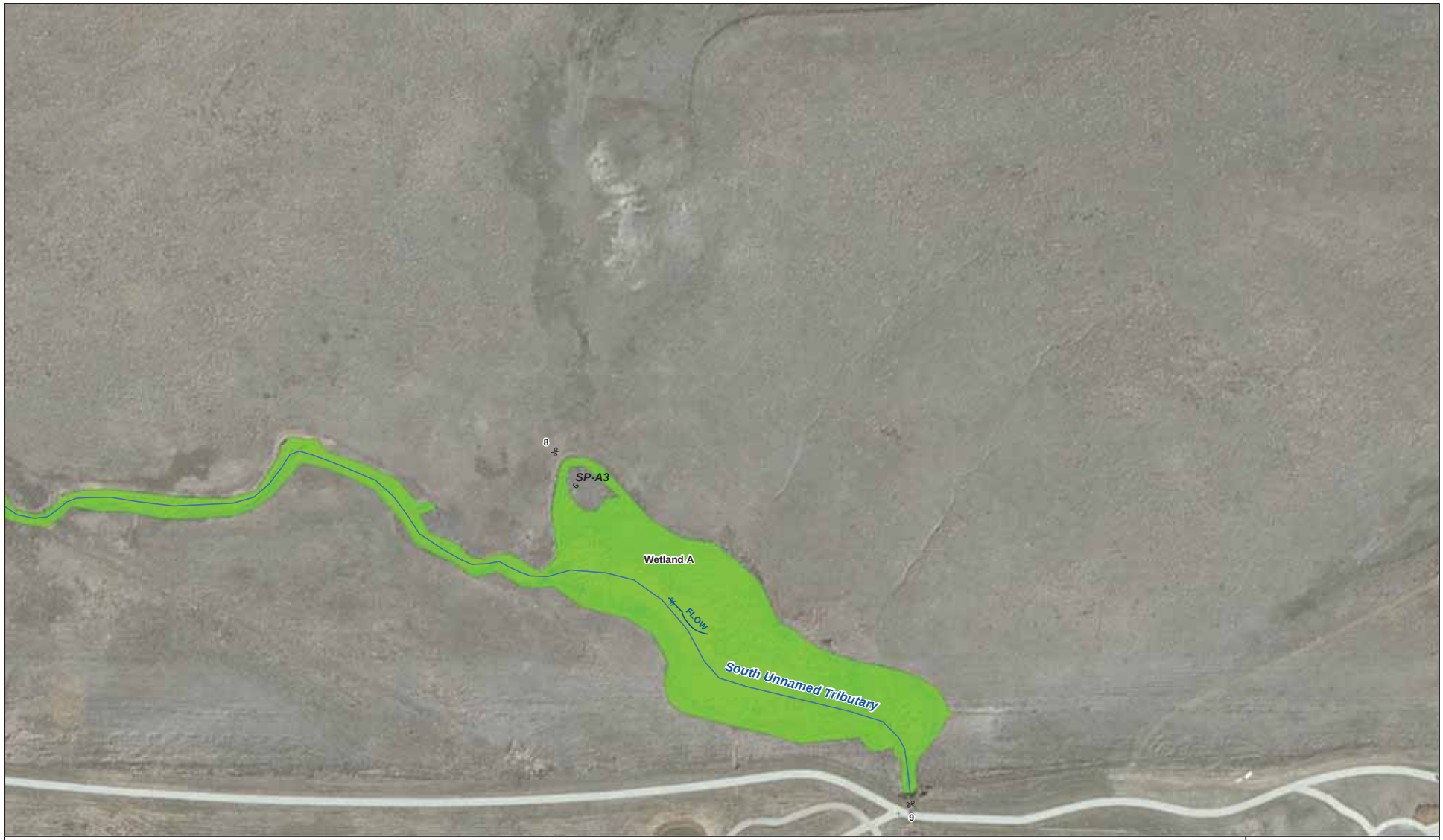
Weld County 330 Acres

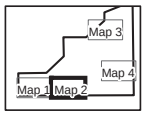
Figure 2
Overview Map

Weld County 330 Acres

Figure 2
Wetlands
Map 1 of 4

10/14/2014





Legend

- Photo Point
- Sample Point
- Other Water
- Wetland

0 50 100 200 300 400 Feet

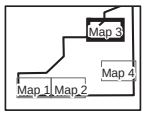
1 in = 100 ft

AlpineEco

Weld County 330 Acres

Figure 2
Wetlands
Map 2 of 4

10/14/2014



Legend

- Photo Point
- Sample Point
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0 50 100 200 300 400 Feet

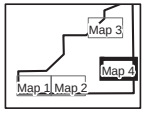
1 in = 100 ft

AlpineEco

Weld County 330 Acres

Figure 2
Wetlands
Map 3 of 4

10/14/2014



Legend

- % Photo Point
- Sample Point
- Other Water
- Wetland

0 50 100 200 300 400 Feet

1 in = 100 ft

AlpineEco

Weld County 330 Acres

Figure 2
Wetlands
Map 4 of 4

10/14/2014

Appendix A
Wetland Determination Data Forms

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: Weld Cty 330 acres City/County: Erie/Weld Sampling Date: 9/12/14

Applicant/Owner: — State: CO Sampling Point: SP-A1

Investigator(s): A. Herb Section, Township, Range: Sec 29, T1N, R68W

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): Concave Slope (%): <1

Subregion (LRR): W Great Plains + Irrig. Land Lat: 40.016153 Long: -105.033655 Datum: NAD83

Soil Map Unit Name: Colombo clay loam NWI classification: —

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks: Low-lying floodplain area w/mix of mesic vegetation. Appears to receive overbank flows occasionally. No WL. Currently wet from significant rains.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
	____ = Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	____ = Total Cover		
Herb Stratum (Plot size: 1 x 3 m)			
1. Elymus trachycaulus	60	Y	FACU
2. Rumex crispus	20	Y	FAC
3. Persicaria lapathifolia	15	N	OBL
4. Atriplex patula	5	N	FACW
5.			
6.			
7.			
8.			
9.			
10.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

% Bare Ground in Herb Stratum ~0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC-): 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks: Edge of WL A – area flooded occasionally; mesic mix.

SOIL

Sampling Point: SP-A1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	2.5YR 4/2	100	–	–	–	–	Silty clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR F**)
- ___ 1 cm Muck (A9) (**LRR F, G, H**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) (**LRR G, H**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR F**)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) (**MLRA 72 & 73 of LRR H**)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR I, J**)
- ___ Coast Prairie Redox (A16) (**LRR F, G, H**)
- ___ Dark Surface (S7) (**LRR G**)
- ___ High Plains Depressions (F16) (**LRR H outside of MLRA 72 & 73**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: –

Depth (inches): –

Hydric Soil Present? Yes ____ No ✓

Remarks: No indicators

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres on Living Roots (C3) (**where not tilled**)
- ___ Presence of Reduced Iron (C4)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres on Living Roots (C3) (**where tilled**)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) (**LRR F**)

Field Observations:

Surface Water Present? Yes ____ No ✓ Depth (inches): ____

Water Table Present? Yes ____ No ✓ Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ✓ No ____ Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: –

Remarks: Saturated to surface - presumably from heavy recent rains. High flows assoc. with Area appears to occasionally receive overbank flows.

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: Weld Cty 330 acres City/County: Erie / Weld Sampling Date: 9/12/14

Applicant/Owner: — State: CO Sampling Point: SP-A2

Investigator(s): A. Herb Section, Township, Range: Sec 29, T1N, R68W

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR): W. Great Plains + Irrig. Land Lat: 40.016178 Long: -105.033679 Datum: NAD83

Soil Map Unit Name: Colombo Clay loam NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks: PEM Wetland along South Unnamed Tributary - mostly Typha

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
	____ = Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	____ = Total Cover		
Herb Stratum (Plot size: 1 x 3 m)			
1. Persicaria lapathifolia	60	Y	OBL
2. Typha latifolia	30	Y	OBL
3. Rumex crispus	5	N	FAC
4. Schoenoplectus maritimus	2	N	OBL
5.			
6.			
7.			
8.			
9.			
10.			
	97 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

% Bare Ground in Herb Stratum ~0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC-): 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ___ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: Dense PEM WL dominated by Typha. w/ Persicaria understory

SOIL

Sampling Point: SP-A2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-9	2.5Y4/2	100	—	—	—	—	silty clay	
9-18+	2.5Y4/2	95	10YR5/6	5	C	M	silty clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 of LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: —

Depth (inches): —

Hydric Soil Present? Yes ✓ No ___

Remarks: Depleted matrix –

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres on Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres on Living Roots (C3) **(where tilled)**
- ✓ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ✓ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): ___

Water Table Present? Yes ✓ No ___ Depth (inches): 6

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

—

Remarks: Surface water (in channel of South Tributary) w/in ~5' - Source of WL hydrology is tributary – via capillary action + overbank flows

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: Weld Cty 330 acres City/County: Erie / Weld Sampling Date: 9/12/14

Applicant/Owner: – State: CO Sampling Point: SP-A3

Investigator(s): A. Herb Section, Township, Range: Sec 29, T1N, R68W

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR): W. Great Plains + Irrig. Land Lat: 40.015583 Long: -105.029366 Datum: NAD83

Soil Map Unit Name: Colombo clay loam NWI classification: –

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks: Small UPL island associated w/ South Unnamed Tributary. Occasionally flooded but not wetland.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
	____ = Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	____ = Total Cover		
Herb Stratum (Plot size: 1x3M)			
1. Cirsium arvense	60	Y	FACU
2. Atriplex patula	20	Y	FACW
3. Rumex crispus	5	N	FAC
4. Typha latifolia	5	N	OBL
5.			
6.			
7.			
8.			
9.			
10.			
	90 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

% Bare Ground in Herb Stratum ~5-10

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC-): 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ___ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks: Weedy upland island surrounded by mostly Typha dominated WL.

SOIL

Sampling Point: SP-A3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-18	10YR 3/3	100	—	—	—	—	silty clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 of LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: —

Depth (inches): —

Hydric Soil Present? Yes ____ No ✓

Remarks: No indicators

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres on Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres on Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present? Yes ____ No ✓ Depth (inches): ____

Water Table Present? Yes ____ No ✓ Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No ✓ Depth (inches): ____

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

—

Remarks: No hydrology indicators; island ~ 1-1.5' V above wetland

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: Weld Cty 330 acres City/County: Erie / Weld Sampling Date: 9/16/14

Applicant/Owner: – State: CO Sampling Point: SP-B1

Investigator(s): A. Herb Section, Township, Range: Sec 29, T1N, R68W

Landform (hillslope, terrace, etc.): pond/depression Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR): W. Great Plains + Irrig. Land Lat: 40.023760 Long: -105.021692 Datum: NAD 83

Soil Map Unit Name: Midway-Shingle Complex NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No _____	**Is the Sampled Area within a Wetland?** Yes ✓ No _____
Hydric Soil Present?	Yes ✓ No _____	
Wetland Hydrology Present?	Yes ✓ No _____	

Remarks: Small pond in Unnamed Tributary (North). Typha filled + seasonally flooded. Receives surface flows, incl. discharge from nearby spring

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
Herb Stratum (Plot size: 1 x 3 m)			
1. Typha angustifolia	80	Y	OBL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	80 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum ~20

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC−): 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks: Typha monotypical stand in pond bottom

SOIL

Sampling Point: SP-B1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	2.5y5/3	60	2.5y5/1	40	C	M	silty clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ✓ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR F**)
- ___ 1 cm Muck (A9) (**LRR F, G, H**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) (**LRR G, H**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR F**)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) (**MLRA 72 & 73 of LRR H**)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR I, J**)
- ___ Coast Prairie Redox (A16) (**LRR F, G, H**)
- ___ Dark Surface (S7) (**LRR G**)
- ___ High Plains Depressions (F16) (**LRR H outside of MLRA 72 & 73**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: –

Depth (inches): –

Hydric Soil Present? Yes ✓ No ___

Remarks: H_2S in both layers; also may be some contaminated soil – possibly a hydrocarbon smell

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ✓ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ✓ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ✓ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ✓ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres on Living Roots (C3) (**where not tilled**)
- ___ Presence of Reduced Iron (C4)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ✓ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres on Living Roots (C3) (**where tilled**)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ✓ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) (**LRR F**)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): ___

Water Table Present? Yes ___ No ✓ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

2013 aerial photo – inundated

Remarks: Uppermost pond in Unnamed Trib (North); WL hydrology from ponding surface flows, incl. discharge from seasonal spring

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: Weld Cty 330 acres City/County: Erie/Weld Sampling Date: 9/16/14

Applicant/Owner: – State: CO Sampling Point: SP-B2

Investigator(s): A. Herb Section, Township, Range: Sec 29, T1N, R68W

Landform (hillslope, terrace, etc.): pond/depression Local relief (concave, convex, none): Concave Slope (%): <1

Subregion (LRR): W. Great Plains Irrig. Land Lat: 40.023875 Long: -105.021561 Datum: NAD83

Soil Map Unit Name: Midway-Shingle Complex NWI classification: –

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks: Edge of pond – occasionally flooded

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ = Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	____ = Total Cover		
Herb Stratum (Plot size: 1 x 3m)			
1. Convolvulus arvensis	30	Y	UPL
2. Bassia scoparia	30	Y	FACU
3. Solanum triflorum	10	N	UPL
4. Rumex crispus	5	N	FAC
5. Verbena bracteata	2	N	FACU
6.			
7.			
8.			
9.			
10.			
	77 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

% Bare Ground in Herb Stratum ~20-25

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC–): 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species ____	x 1 =	____
FACW species ____	x 2 =	____
FAC species ____	x 3 =	____
FACU species ____	x 4 =	____
UPL species ____	x 5 =	____
Column Totals: ____ (A)		____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ___ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks: Weedy upland edge of pond

SOIL

Sampling Point: SP-B2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	2.5Y 4/2	95	2.5Y 5/8	5	C	M	Silty clay – dry	
3-16	2.5Y 5/3	60	2.5Y 3/3	40	C	M	Silty clay – dry	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 of LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: –

Depth (inches): –

Hydric Soil Present? Yes ✓ No ___

Remarks: Upper layer of soil considered hydric – likely from occasional ponding

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres on Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres on Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ✓ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): ___

Water Table Present? Yes ___ No ✓ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No ✓ Depth (inches): ___

Wetland Hydrology Present? Yes ___ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Inundation visible on 2013 aerial (after huge rain events)

Remarks: Occasionally flooded – when pond at its fullest – but no WL hydrology

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: Weld Cty 330 acres City/County: Erie / Weld Sampling Date: 9/16/14

Applicant/Owner: — State: Co Sampling Point: SP-W1

Investigator(s): A. Herb Section, Township, Range: Sec 29, T1N, R68W

Landform (hillslope, terrace, etc.): Swale Local relief (concave, convex, none): Concave Slope (%): 1-2

Subregion (LRR): W. Great Plains + Irrig. Land Lat: 40.017719 Long: -105.018440 Datum: NAD83

Soil Map Unit Name: Ulm clay loam NWI classification: —

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No ✓	**Is the Sampled Area within a Wetland?** Yes _____ No ✓
Hydric Soil Present?	Yes _____	No ✓	
Wetland Hydrology Present?	Yes ✓	No _____	

Remarks: Swale vegetated w/mesic mix of species. Occasional surface flows but no WL.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
Herb Stratum (Plot size: 1 x 3m)			
1. Rumex crispus	30	Y	FAC
2. Helianthus annuus	25	Y	FACU
3. Conyza canadensis	5	N	UPL
4. Typha latifolia	5	N	OBL
5. Hordeum jubatum	2	N	FACW
6. Panicum capillare	2	N	FAC
7.			
8.			
9.			
10.			
	69 = Total Cover 9/16		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum ~30

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC-): 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks: Mesic mix in bottom of swale; scattered Typha

SOIL

Sampling Point: SP-U1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR3/2	100	—	-	-	-	silty clay	ox rhizos
4-16	10YR4/2	100	—	-	-	—	silty clay	no ox rhizos

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR F**)
- ___ 1 cm Muck (A9) (**LRR F, G, H**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) (**LRR G, H**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR F**)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) (**MLRA 72 & 73 of LRR H**)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR I, J**)
- ___ Coast Prairie Redox (A16) (**LRR F, G, H**)
- ___ Dark Surface (S7) (**LRR G**)
- ___ High Plains Depressions (F16) (**LRR H outside of MLRA 72 & 73**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: —

Depth (inches): —

Hydric Soil Present? Yes ___ No ✓

Remarks: No hydric soil indicators

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres on Living Roots (C3) (**where not tilled**)
- ___ Presence of Reduced Iron (C4)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ✓ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres on Living Roots (C3) (**where tilled**)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ✓ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) (**LRR F**)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): ___

Water Table Present? Yes ___ No ✓ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No ✓ Depth (inches): ___

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

—

Remarks: Two secondary indicators obs. Receives occasional surface flows from landfill to east

Appendix B
Site Photographs

Photo 1: Wetland A, looking northeast from Vista Parkway (upstream)

Photo 2: Wetland A, looking northeast (upstream)

Photo 3: Wetland A, looking north (downstream)

Photo 4 : Wetland A, looking east (upstream)

Photo 5: Wetland A, looking southwest (downstream)

Photo 6: Wetland A, looking north at SP-A1 (double flag in foreground) and SP-A2 (double flag in background)

Photo 7: Wetland A, looking southeast (upstream)

Photo 8: Upland sample point (SP-A3) adjacent to Wetland A, looking southeast

Photo 9: Wetland A, looking north from golf course (downstream)

Photo 10: Wetland and Pond B, looking southwest

Photo 11: Wetland and Pond B, looking southwest at SP-B2 (double flag)

Photo 12: Wetland and Pond C, looking southwest from the Pond B dam

Photo 13: Wetland and Pond B, looking northeast

Photo 14: Pond C, looking southwest from the inlet

Photo 15: Wetland below Pond C, looking northeast

Photo 16: Start of Channel B (at spring; marked by shovel), looking west

Photo 17: Channel B between spring and Pond B, looking southwest

Photo 18: Upland sample point (SP-U1), looking southwest

Appendix B

USFWS IPaC Trust Resources Report

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Weld County, Colorado

Local office

Colorado Ecological Services Field Office

(303) 236-4773
(303) 236-4005

MAILING ADDRESS
Denver Federal Center
P.O. Box 25486
Denver, CO 80225-0486

PHYSICAL ADDRESS
134 Union Boulevard, Suite 670
Lakewood, CO 80228-1807

http://www.fws.gov/coloradoES
http://www.fws.gov/platteriver

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population, even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information.
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Preble's Meadow Jumping Mouse Zapus hudsonius preblei There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/4090	Threatened

Birds

NAME	STATUS
Least Tern Sterna antillarum This species only needs to be considered if the following condition applies: • Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska. No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/8505	Endangered
Mexican Spotted Owl Strix occidentalis lucida There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/8196	Threatened
Piping Plover Charadrius melodus This species only needs to be considered if the following condition applies: • Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska. There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/6039	Threatened

Whooping Crane Grus americana This species only needs to be considered if the following condition applies: • Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska. There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/758	Endangered

Fishes

NAME	STATUS
Pallid Sturgeon Scaphirhynchus albus This species only needs to be considered if the following condition applies: • Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska. No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7162	Endangered

Flowering Plants

NAME	STATUS
Colorado Butterfly Plant Gaura neomexicana var. coloradensis There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/6110	Threatened
Ute Ladies'-tresses Spiranthes diluvialis No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2159	Threatened
Western Prairie Fringed Orchid Platanthera praeclara This species only needs to be considered if the following condition applies: • Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska. No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/1669	Threatened

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date

range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON (IF A BREEDING SEASON IS INDICATED FOR A BIRD ON YOUR LIST, THE BIRD MAY BREED IN YOUR PROJECT AREA SOMETIME WITHIN THE TIMEFRAME SPECIFIED, WHICH IS A VERY LIBERAL ESTIMATE OF THE DATES INSIDE WHICH THE BIRD BREEDS ACROSS ITS ENTIRE RANGE. "BREEDS ELSEWHERE" INDICATES THAT THE BIRD DOES NOT LIKELY BREED IN YOUR PROJECT AREA.)
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Oct 15 to Jul 31
Burrowing Owl *Athene cunicularia* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9737	Breeds Mar 15 to Aug 31
Golden Eagle *Aquila chrysaetos* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31
Lark Bunting *Calamospiza melanocorys* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds May 10 to Aug 15
Lesser Yellowlegs *Tringa flavipes* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds elsewhere
Long-billed Curlew *Numenius americanus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5511	Breeds Apr 1 to Jul 31
Mccown's Longspur *Calcarius mccownii* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9292	Breeds May 1 to Aug 15
Semipalmated Sandpiper *Calidris pusilla* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Willet *Tringa semipalmata* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 20 to Aug 5

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

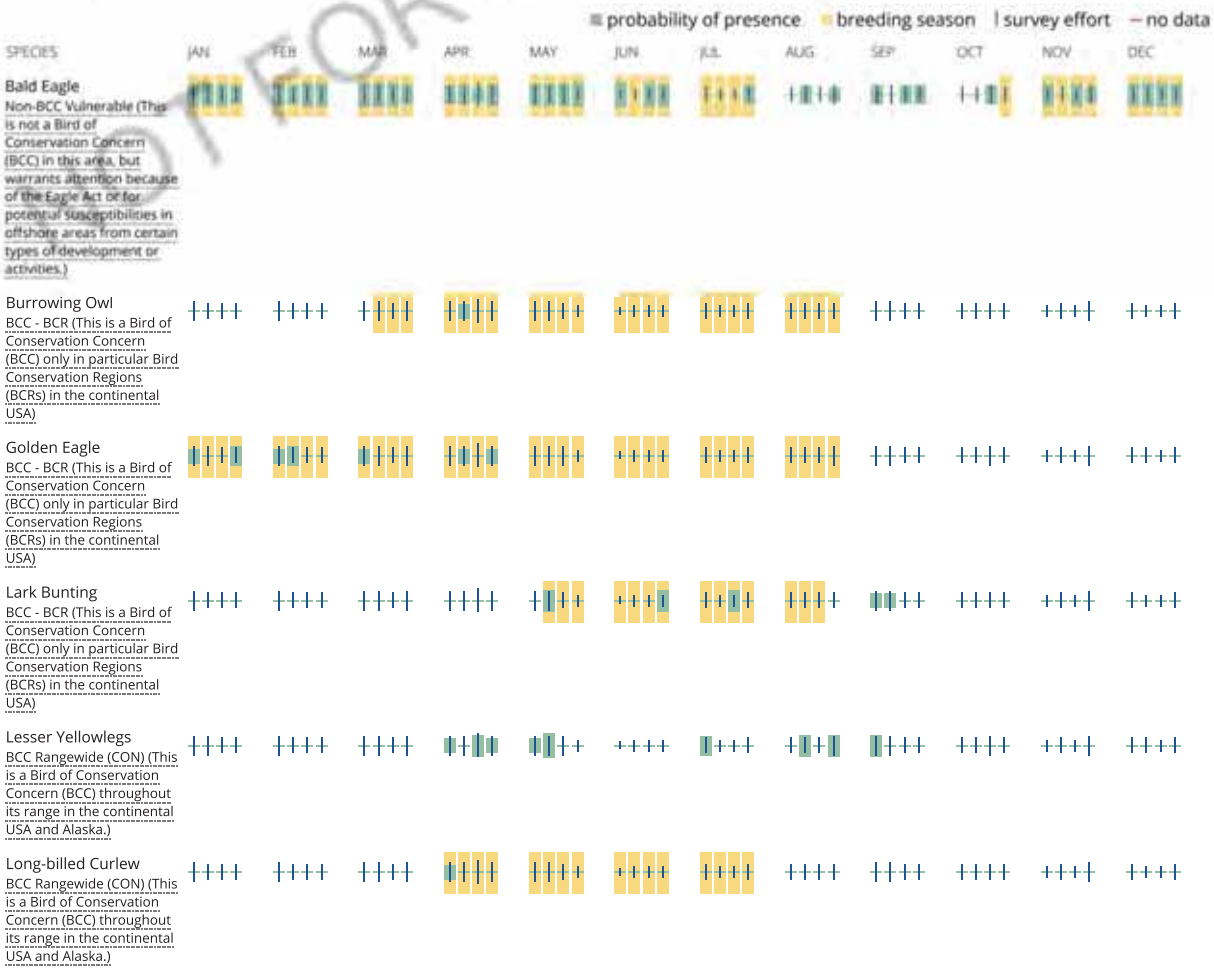
Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

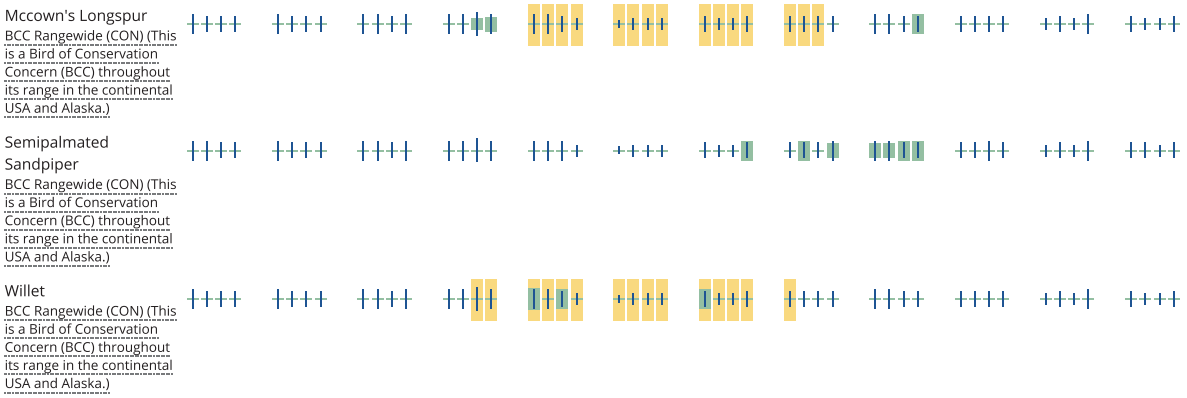
Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.





Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures and/or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the AKN Phenology Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

FRESHWATER EMERGENT WETLAND
PEM1A

RIVERINE
R4SBC

A full description for each wetland code can be found at the National Wetlands Inventory website

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal

zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

Appendix C

Photo Location Map and Site Photographs

Photo Location Map

Photo Point #9: View north of weedy midgrass prairie between landfill borrow soil and Vista Parkway at northwest property corner.

Photo Point #9: View northeast of weedy midgrass prairie between landfill borrow soil and Vista Parkway at northwest property corner.

Photo Point #9: View east along northern property line of weedy midgrass prairie at northwest property corner.

Photo Point #9: View southeast of midgrass prairie slope down to southern drainage at northwest property corner.

Photo Point #9: View south of midgrass prairie and Vista Parkway Right of Way landscaping at northwest property corner.

Photo Point #10: View northeast of southern channel/wetlands and abutting midgrass prairie at Vista Parkway culvert from western property line.

Photo Point #10: View east of southern channel/wetlands and abutting midgrass at Vista Parkway culvert from western property line.

Photo Point #10: View southeast of southern channel/wetlands and abutting midgrass at Vista Parkway culvert from western property line.

Photo Point #11: View west of good quality midgrass prairie, Vista Parkway, and Airpark Neighborhood beyond near southwestern property corner.

Photo Point #11: View northwest of good quality midgrass prairie transition to southern drainage/wetlands near southwestern property corner.

Photo Point #11: View north of good quality midgrass prairie transition to southern drainage/wetlands toward Denver Regional Landfill near southwestern property corner.

Photo Point #11: View northeast of good quality midgrass prairie transition to southern drainage/wetlands toward Front Range Landfill near southwestern property corner.

Photo Point #12: View west of disturbed midgrass prairie and pipeline reclamation corridor from southeastern property corner.

Photo Point #12: View northwest of disturbed midgrass prairie and pipeline reclamation corridor from southeastern property corner.

Photo Point #12: View north of disturbed midgrass prairie and pipeline reclamation corridor from southeastern property corner.

Photo Point #13: View south of disturbed midgrass prairie, pipeline reclamation corridor, and prairie dog colony from eastern property line at existing site entrance on CR5.

Photo Point #13: View southwest of disturbed midgrass prairie, pipeline reclamation corridor, and prairie dog colony from eastern property line at existing site entrance on CR5.

Photo Point #13: View west of disturbed midgrass prairie, pipeline reclamation corridor, prairie dog colony, and Denver Regional Landfill from eastern property line at existing site entrance on CR5.

Photo Point #13: View northwest of disturbed midgrass prairie, pipeline reclamation corridor, prairie dog colony, and Denver Regional Landfill from eastern property line at existing site entrance on CR5.

Photo Point #13: View north of disturbed midgrass prairie, pipeline reclamation corridor, and prairie dog colony, and Front Range Landfill from eastern property line at existing site entrance on CR5.

Photo Point #14: View south of disturbed midgrass prairie and pipeline reclamation corridor from northeastern property corner on CR5.

Photo Point #14: View southwest of disturbed midgrass prairie, pipeline reclamation corridor and Denver Regional Landfill from northeastern property corner on CR5.

Photo Point #15: View east of disturbed midgrass prairie, northern ephemeral drainage, prairie dog colony, and Front Range Landfill from northwestern central property corner.

Photo Point #15: View southeast of disturbed midgrass prairie, northern ephemeral drainage, prairie dog colony, and oil and gas staging pad from northwestern central property corner.

Photo Point #15: View south of disturbed midgrass prairie, northern ephemeral drainage, prairie dog colony, and oil and gas staging pad from northwestern central property corner.

Photo Point #16: View east of disturbed midgrass prairie, northern ephemeral drainage, and Front Range Landfill from off-site stock pond berm.

Photo Point #16: View west of northern ephemeral drainage and view of Front Range from off-site stock pond berm.

Photo Point #17: View north of disturbed midgrass prairie and Denver Regional Landfill from northwest diagonal property corner.

Photo Point #17: View northeast of disturbed midgrass prairie, prairie dog colony and Denver Regional Landfill from northwest diagonal property corner.

Photo Point #17: View east of disturbed midgrass prairie, prairie dog colony and Front Range Landfill from northwest diagonal property corner.

Photo Point #17: View southeast of disturbed midgrass prairie, prairie dog colony and Vista Ridge Neighborhood from northwest diagonal property corner.

Photo Point #17: View south of disturbed midgrass prairie, prairie dog colony and Vista Ridge Neighborhood from northwest diagonal property corner.

Photo Point #17: View southwest of disturbed midgrass prairie, prairie dog colony and Vista Ridge Neighborhood from northwest diagonal property corner.

Photo Point #18: View north of disturbed midgrass prairie and prairie dog colony from northwest diagonal property corner.

Photo Point #18: View east of disturbed midgrass prairie and prairie dog colony from northwest diagonal property corner.

Photo Point #18: View southeast of prairie dog colony, disturbed midgrass prairie leading down to southern drainage from northwest diagonal property corner.

Photo Point #18: View south of prairie dog colony, disturbed midgrass prairie leading down to southern drainage from northwest diagonal property corner.

Photo Point #18: View southwest of prairie dog colony, disturbed midgrass prairie leading down to southern drainage from northwest diagonal property corner.

Appendix D

Office of Archaeology and Historic Preservation (OAHP) Letter

HISTORY COLORADO
Office of Archaeology and Historic Preservation
1200 Broadway, Denver, Colorado 80203

Grant Gurnee
Ecosystem Services, LLC
11712 Montgomery Circle
Longmont, CO 80504

October 29, 2019

Re: 2019-15-1
File Search No. 22199

At your request, the Office of Archaeology and Historic Preservation has conducted a search of the Colorado Inventory of Cultural Resources within the area shown in the provided shapefiles, located in the following areas:

PM	T	R	S
6th	1N	68W	29, 32

3 sites and 4 surveys were located in the designated area(s).

If information on any district, site, building, structure, or object in the project area was found, detailed information follows the summary. If no properties were found, but surveys are known to have been conducted in the project area, survey information follows the summary. We do not have complete information on surveys conducted in Colorado, and our site files cannot be considered complete because most of the state has not been surveyed for cultural resources. There is the possibility that as yet unidentified cultural resources exist within the proposed impact area.

Our letter should not be interpreted as formal consultation under Section 106 of the National Historic Preservation Act (36 CFR 800) or the Colorado Register of Historic Places (CRS 24-80.1). In the event that there is federal or state agency involvement, please note that it is the responsibility of the agencies to meet the requirements of these regulations.

We look forward to consulting with you regarding the effect of the proposed project on significant cultural resources in accordance with the Advisory Council on Historic Preservation regulations titled "Protection of Historic Properties" or the Colorado Register of Historic Places, as applicable (http://www.historycolorado.org/oahp/consultation-guidance).

If you have any questions, please contact the Office of Archaeology and Historic Preservation at (303) 866-3392. Thank you for your interest in Colorado's cultural heritage.

Steve Turner, AIA
State Historic Preservation Officer

*Information regarding significant archaeological resources is excluded from the Freedom of Information Act. Therefore, legal locations of these resources must not be included in documents for public distribution.

22199_s_sy

Appendix E
Professional Qualifications

Appendix A
Professional Qualifications

RESUME

Jon Dauzvardis, M.L.A, P.W.S.

Owner/Managing Partner
Senior Restoration Ecologist
Landscape Architect
Wetland Ecologist

AREAS OF EXPERTISE:

- Vegetation Inventories and Mapping
- Habitat Assessment, Functional Assessment and Wetland Delineation
- Aquatic, Wetland, and Riparian Restoration Ecology, Planning and Design
- Landscape Ecology, Planning and Landscape Architecture
- Conservation and Resource Mitigation Bank Support Services
- Grant Funding Support for Conservation and Restoration Projects
- Open Space and Trail Planning, Design and Habitat Management
- Construction Oversight & Best Management Practices
- AutoCAD, Mapping, Presentation Graphics

EDUCATION:

- Master of Landscape Architecture, Texas A&M University, College Station, Texas, 1995
- Bachelor of Science, Environmental Design, University of Missouri, Columbia, 1991
- Architecture Study, Harvard University Graduate School of Design, Cambridge, Massachusetts, 1989

EMPLOYMENT HISTORY:

- 2008-Present, Owner/Manager and Senior Restoration Ecologist, Ecosystem Services, LLC, Erie Colorado
- 2000 – 2011, Senior Restoration Ecologist, Walsh Environmental Scientists and Engineers, LLC, Boulder, Colorado
- 1997 – 2000, Restoration Ecologist, Construction Supervisor, Aquatic and Wetland Company, Boulder, Colorado
- 1996-1997, Landscape Architect, Design Studios West, Denver, Colorado
- 1995-1996, Landscape Architect, Wenk Associates, Denver, Colorado
- 1994-1995, Graduate Researcher, ALCOA – Texas A&M University, College Station, Texas
- 1994, Johnson County Parks and Recreation Department, Shawnee Mission, Kansas
- 1992-1994, Grounds Maintenance Superintendent, Brazos County, Texas

CONTINUING EDUCATION:

- Stream Functions Pyramid Workshop, Denver, CO - 2014
- Colorado Natural Heritage Program, Wetland Plant Identification - 2014
- Colorado Natural Heritage Program, Ecological Integrity Assessment for Colorado Wetlands - 2013
- FACWet – Functional Assessment of Colorado Wetlands - 2010, 2012 and 2013
- ESRI, ARC View Geographic Information System (GIS) Training, 1996
- Bicycle Planning and Facilities Training, 1994
- AutoCAD Drafting and Design, Self-taught, 1991

CERTIFICATIONS:

- Professional Wetland Scientist Certification (# 1699), Society of Wetland Scientists Certification Program, 2004

1455 Washburn Street Erie, CO 80516 (p): 970-812-3267 (e): jon@ecologicalbenefits.com

EXPERIENCE SUMMARY:

Mr. Dauzvardis is a founder and managing partner of Ecosystem Services, LLC (**ecos**), an ecological planning and design business dedicated to the restoration, enhancement and creation of aquatic, wetland and riparian habitat. Jon is a certified Professional Wetland Scientist with over 25 years of experience working in the fields of landscape architecture and ecological restoration in Colorado, Wyoming, Texas, Kansas and the Intermountain West. Jon's academic and professional work history in housing design and construction, community planning, architecture, landscape architecture, ecological planning and restoration is unique and makes him a valuable and multi-faceted asset to his company, clients and their projects. His diverse knowledge and skills in landscape planning, habitat design, bioengineering, and hands-on experience demonstrate that he can easily negotiate between art and science, man-made and natural systems, generalities and detail, and from concept to construction. Jon takes a practical and realistic approach to problem solving, concentrating on broad scale ecological master planning simultaneously with fine scale design of aquatic, wetland, riparian and terrestrial habitats. As a restoration ecologist, Jon specializes in restoring and enriching habitat structure, stability and health and how to manage landscapes and natural systems so that they function, change, and respond positively over time. Jon's strengths are rooted in his understanding of natural and landscape processes; finding design solutions that integrate the needs of people, wildlife, and visual quality; sustaining ecosystem goods and services; and integration of nature-based recreation and environmental education programs and facilities.

RELEVANT PROJECT EXPERIENCE:

Mr. Dauzvardis has been an essential team lead and player in hundreds of habitat assessments; permitting efforts; master plans; and aquatic, wetland, and riparian habitat design and mitigation projects. The following is a sampling of select projects and clientele that Jon has successfully completed or is currently involved with:

Habitat Assessment and Regulatory Compliance

Mr. Dauzvardis routinely performs ecological site and resource impacts assessments, jurisdictional wetland determinations and functional assessments to assist clients in site planning, design, and permitting processes. Assessment methods established by the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and Colorado Department of Transportation among others are used to assess habitat elements and screen sites for threatened and endangered plants and animals, wetlands, migratory birds and other wildlife. Jon stresses habitat impact avoidance and minimization to preserve a site's ecological benefits and to minimize regulatory constraints, timing and permitting costs. Jon has performed a multitude of site assessments, delineations and prepared permits, including but not limited to the following notable projects as well as others listed throughout this resume:

- **Banning Lewis Ranch, Colorado Springs, CO –** ecos was hired by Norwood Homes to perform and ecological assessment of wetlands, Sand Creek, Jimmy Camp Creek and its tributaries; and provide regulatory guidance for the Banning Lewis Ranch (BLR), an 18,000-acre site that will double the size of Colorado Springs. Part of Jon's work on the project included mapping and buffer recommendations on how to best conserve pristine prairie and sandy creeks that are highly susceptible to degradation caused by urbanization.
- **Bellvue Pipeline Project, Larimer County, CO** – ecos was retained by the City of Greeley as Best Management Practices (BMP) Facilitators to provide pre-construction documentation post-construction oversight of pipeline reclamation processes. Essential responsibilities include meeting with landowners prior to construction to facilitate project understanding and post-construction outcomes; to document landowner needs and wants relative to project goals and land use; and to document and monitor pre- and post-construction reclamation and maintenance requirements.
- **Georgetown Lake, Georgetown, CO –**ecos was hired to prepare an office level assessment report of ecological resources to describe the physical/ecological characteristics of the Project area and evaluate the potential effects of the construction of a loop trail project on environmental issues and species of concern to support a GOCO grant application. Items evaluated and documented, include site location/ownership, general site characteristics, current land use, proposed impacts, possible effects on Federal– and State-listed T&E animal and plant species, unique or important wildlife, water quality, water bodies, wetlands, and floodplains, stormwater runoff, sedimentation, soil erosion, and invasive species. The assessment report also included mitigation measures, project benefits, and environmental compliance recommendations under applicable regulatory programs.

- **Appraisal Support Documentation Report for the 1st Bank Parcel, Colorado Springs, CO** - ecos was retained by 1st Bank Holding Company to perform a Preble's meadow jumping mouse (PMJM) habitat assessment, mitigation cost analysis, and conceptual lot layout for the approximate 9.4-acre Parcel located adjacent to the Northgate Open Space along Smith Creek. Jon was responsible for preparing the lot layout, existing habitat aerial photo interpretation/delineation, proposed conceptual mitigation, and quantification of impacts and associated mitigation to ascertain appraisal value of the site if it were to be developed.
- **Encana Oil and Gas (USA), Denver Julesburg Basin, CO** – Encana hired ecos to assess their ecological constraints, recommend means and methods to avoid, minimize and permit impacts; and to mitigate, restore and prepare ecological management plans for their drilling and pipeline operations in the Denver Julesburg basin. Jon's role on the team is to perform site assessments, research background data, and prepare assessment reports and mapping data that can be utilized by Encana's project managers and geographic information systems (GIS) department to proactively track ecological resources before issues arise. In addition to client consultation, Jon is responsible for tracking drill site schedules, constraints, restoration and management efforts in a data base and reporting said information to Encana's project manager on a regular basis.
- **Tollgate Creek Riparian and Wetland Habitat Assessment, Aurora, CO** – Jon performed high level aerial photo interpretation and delineation of riparian and wetland habitat along Toll Gate Creek and East Toll Gate Creek from confluence with Sand Creek upstream to East Hampden Avenue. The delineation was performed in Google Earth and imported into AutoCAD by digitizing riparian and wetland habitat zones. Once complete, the data was turned over to the project engineer to incorporate into a Drainage Master Plan for the Urban Drainage and Flood Control District (UDFCD).
- **Eagle River Meadows Ecological Inventory and Strategic Wetland Action Plan, Edwards, CO** – Mr. Dauzvardis delineated, assessed, and provided an analysis of potential adverse effects to wetlands within a complex site adjacent to the Eagle River. Jon also developed a strategic process and decision making tool to determine avoidance, minimization, low impact development (LID), and mitigation measures in support of a County Sketch Plan application for a Multi-use Health Care Community.
- **Mesa County Colorado Riverfront Trail, Grand Junction, CO** – Jon performed wetland delineation, jurisdictional determination, Section 404 Permitting; and prepared wetland mitigation plans to construct approximately two miles of regional trail along the north side of the Colorado River between the James M. Robb and the Colorado River State Park at Corn Lake.
- **ARCO Upper Clark Fork River Basin Superfund Site Functional Wetland Assessment, MT** – Between 2000 and 2008, Jon managed the assessment team and performed extensive wetland delineation, GPS surveying, functional assessments, and impact mapping and analysis covering a 200 square mile Superfund Site affected by historic mining practices. Assessments we done in preparation for soil remediation of heavy metals, capping of tailings ponds, sediment and dam removal, and implementation of compensatory wetland mitigation plans required under a consent decree. Assessment areas included the Anaconda Smelter, Old Works, Opportunity Ponds, and Milltown Reservoir.
- **Jefferson County Highways & Transportation Department Gunbarrel Bridge Replacement, Oxyoke, CO** – Jon consulted with the USACE, USFWS, CDOT, and the FHWA to document regulatory requirements. Produced a CDOT Wetland Finding Report, Biological Assessment, Preble's meadow jumping mouse and wetland mitigation plans, and helped acquire a Section 404 Permit and Biological Opinion.
- **Pole Canyon Wind Farm, Babcock and Brown, Huerfano County,** CO – Assessed and prepared critical issues analysis and County 1041 Permit application for a 125-megawatt wind farm and associated transmission lines located on a 5,800-acre site. The project included detailed site assessments to document the presence or absence of potential development constraints and site-specific ecological conditions as well as preparation of permit maps, plot plans, and environmental analyses, alternatives analysis, and mitigation measures.
- **Dalton Property Wetland Assessment, Longmont, CO** – Provided site assessment, regulatory analyses, and developed a restoration plan for critical riparian and wetland habitat along Left Hand Creek in Boulder County, CO.
- **Colowyo Coal Mine Wetland Delineation, Meeker,** CO – Delineated 1.5 miles of jurisdictional waters and wetlands in preparation for wetland mitigation design along West New Goodspring Creek.
- **Lafarge Northbank Resources Gravel Pit Wetland Assessment, Rifle, CO** – Delineated and acquired a jurisdictional determination from the USACE for complex tailwater and riparian wetlands along the

Colorado River. Prepared gravel pit reclamation plans aimed at providing suitable shallow-water lake edge wetlands to serve as compensatory wetland mitigation.

- **Jefferson County Highways & Transportation Department Highway 73 Expansion, Conifer,** CO – Performed presence/absence study, habitat assessment and documentation of wetlands, Migratory Birds, State Species of Concern, and federally listed T&E Species including Bald eagle, Preble's meadow jumping mouse, the Pawnee montane skipper butterfly and Colorado butterfly plant along a one-mile corridor of highway.
- **Flying Horse Ranch and the Club at Flying Horse Golf Course, Colorado Springs, CO** – Conducted an assessment of wetland habitat, impact avoidance and minimization and Section 404 of the Clean Water Act permitting for a 1500-acre mixed use development and Weiskopf golf course design being implemented by Neiber Golf.
- **C-Lazy-U and Horn Ranch Environmental Assessments, Granby, CO** – Performed site assessment of ecological opportunities and constraints of aquatic, riparian, wetland and threatened and endangered species habitat along the Colorado River for the development and enhancement of fishing/resort ranch amenities.
- **Village at Avon, Avon, CO** – Delineated wetlands and prepared a Section 404 Permit for the town center expansion and low-density ranchette development.
- **Residential Developers and Realtors** – Performed numerous wetland and T&E species habitat ecological assessments, wetland delineations, and prepared Clean Water Act Section 404 Permits and mitigation plans for residential developers and realtors, including: 4 Site Investments, Nor'wood, Proterra Properties, Denver Transit Oriented Development Fund, La Plata Communities, Windsor Ridge Homes, Clearwater Communities, Schuck Corporation, Equinox Land Group, DR Horton, Melody Homes, Standard Pacific Homes, Gateway American Properties, Zephyr Real Estate Company, Lowell Development Partners, and Palmer-McAlister, Classic Communities, Stoll Properties, Karen Bernardi, Colorado Commercial Builders, Terra Visions, Smith Creek Holdings, Picolan, Realty Development Services, Northgate Properties.
- **Commercial and Industrial Developers** - Performed numerous wetland and T&E species habitat ecological assessments, wetland delineations, and prepared Clean Water Act Section 404 Permits and mitigation plans for commercial and industrial developers, including: Atira Group, Leadership Circle, Ridgeway Valley Enterprises, Morley Companies, HF Holdings, Regency Centers, Miller-Weingarten, Gulf Coast Commercial Development, Traer Creek, Mountain Property Associates, Morley Golf, Executive Consulting, Inc.
- **Architectural and Engineering Companies** – Jon has performed numerous wetland and T&E species habitat ecological assessments, wetland delineations, and prepared Clean Water Act Section 404 Permits and mitigation plans for A&E firms, including: William Guman and Associates, JVA, Beyers Group, Engineering Analytics, Classic Consulting Engineers, J3 Engineering, DHM Design, Del-Mont Consultants, JW Nakai and Associates, Nolte and Associates, JR Engineering, Hyrdosphere, Executive Consulting Engineers, Muller Engineering, Farnsworth Group.
- **Counties, Municipalities, Metro Districts and Quasi-Public Institutions** – Mr. Dauzvardis has performed numerous wetland and T&E species habitat ecological assessments, wetland delineations, and prepared Clean Water Act Section 404 Permits and mitigation plans for counties, municipalities, and quasi-public institutions, including: City of Louisville Highway 42 and 96th Street realignment, City of Westminster Jim Baker Reservoir and Standley Lake Protection Projects, Jefferson County Highway 73 and 67 Improvement Projects, Todd Creek Village Metro District, Town of Monument/Triview Metro District, Boulder Community Hospital, and City of Fort Collins Regulatory Fact Sheets Preparation Project, Todd Creek Village Metro District on-call consultant, Three-lakes Water and Sanitation District, City of Greeley,
- **Educational Institutions** – Performed numerous wetland and T&E species habitat ecological assessments, wetland delineations, and prepared Clean Water Act Section 404 Permits and mitigation plans for educational institutions, including: Colorado Mountain College - Steamboat Springs, The Classical Academy – Colorado Springs, and Coal Ridge High School – Rifle.
- **Wind Energy Developers** – Performed numerous wetland and T&E species habitat ecological assessments, wetland delineations, and critical issues analyses for wind development projects, including: Cedar Creek Windfarm – Weld County, CO, Wheatland Windfarm – Platte County, WY, Silver Mountain Windfarm – Huerfano County, CO, Pole Canyon Windfarm, Huerfano Count, CO.

- **Mining Companies** – Performed wetland and T&E species habitat ecological assessments, wetland delineations, and critical issues analyses for mining companies, including: Brannan Sand and Gravel Company, Lafarge and Kennecott Coal.

Ecological Master Planning

- **Jackson Creek Land Company PMJM and Wetland Mitigation, Colorado Springs, CO** – ecos has been performing Preble's meadow jumping mouse (PMJM) habitat biological assessments, conservation, mitigation planning and design throughout its range since 1994. Among numerous other private land developers in the Colorado Springs areas, ecos is currently assisting the Jackson Creek Land Company and Triview Metropolitan District with the implementation of physical habitat conservation and mitigation measures, including shortgrass prairie, upland hibernaculum, and riparian habitat restoration. Jon is responsible for mapping, design assessment and restoration plan preparation.
- **Park Creek Mitigation Bank, Fort Collins, CO –** ecos was retained by Burns and McDonnell to assess, map, and prepare preliminary mitigation design of aquatic, wetland, riparian and terrestrial habitat in support of a mitigation banking prospectus. Upon completion and acceptance of the prospectus by the USACE, ecos has been tasked to manage the baseline assessment of the site, including groundwater testing, topographic surveys, and hydrology; prepare a detailed habitat design for inclusion in mitigation banking instrument; as well as coordinate design-build process with a selected nursery and contractor. Jon has been responsible for the mapping and preparation of design documents and will co-manage construction and long-term monitoring to help our client meet their performance criteria and sell bank credits.
- **Front Range Umbrella Mitigation Bank, CO –** ecos was retained by Restoration Systems, a nationally renowned wetland mitigation banking firm, to help identify and prepare conceptual design plans for mitigation banking sites to establish the Front Range Umbrella Mitigation Bank (Bank). The purpose of the Bank is to provide compensatory mitigation credits for unavoidable, permitted impacts to aquatic, wetland, riparian, upland, wildlife, and threatened and endangered (T&E) species habitat regulated under the Clean Water and Endangered Species Acts; and to restore, enhance and preserve valuable natural resource functions at degraded mitigation sites within multiple watersheds along Colorado's Front Range. Currently, the Bank is developing banks sites that serve the Cache la Poudre, St. Vrain, Upper South Platte, Fountain and Upper Arkansas watersheds. Jon's primary role on the team is to perform functional habitat assessments; prepare mapping and graphics of baseline and future conditions; grading and plant community design based on hydrologic, hydraulic, and geomorphic modelling and engineering; and communicate with landowners and stakeholders regarding the process, technicalities, and outcomes.
- **Sand Creek Channel Improvements Stability Analysis at Indigo Ranch, Colorado Springs, CO** - ecos was retained to perform an analysis of channel stability under proposed development conditions for a 1.17 mile reach of Sand Creek. Ecos utilized existing vegetation composition data, density and height within the Project reach as a basis; and compared the 10-year and 100-year storm event modelling data (specifically flow velocity, flow depth and shear stress) to reference literature to provide a professional opinion regarding the future stability of the channel under developed conditions. The analysis of channel stability for the proposed Project assumes a bioengineering and biotechnical approach that preserves and enhances the existing vegetation, as well as substrate cohesion and stability, within the channel and its streambanks. The Stability Analysis will likely serve as a benchmark study for the City of Colorado Springs to use to preserve other naturally stable channels.
- **Brush Creek Ranch Stewardship Plan, Saratoga, WY** – Brush Creek Ranch Stewardship Plan, Fishery Enhancement and Bank Stabilization, Saratoga, WY – Mr. Dauzvardis managed the organization, generation and graphic design of the Ranch Stewardship Plan. Jon assessed and prepared stewardship goals, objectives, and implementation action items, including ranch-wide master planning of the trail and recreational systems and design of the Brush Creek riparian corridor trail. Trail and recreation planning and design focused on universal access, habitat sensitivity, environmental education, wildlife observation opportunities and unique landscape experiences. Simultaneously with the master plan, Jon developed revegetation plans to support geomorphic stream alterations and bank stabilization to enhance the creek fishery. Jon was responsible for the design and supervised construction of a cold-water pond to be used by novice anglers to learn the art and experience the pleasure of catching trout.
- **Town of Erie, Comprehensive Plan, Parks Recreation Open Space and Trails Master Plan, and Natural Areas Inventory, Erie, CO -** As a former 8-year Member, Chair, and Vice Chair of the Town Erie

Open Space and Trails Advisory Board (OSTAB) and an Erie resident and small business owner, Jon has an intimate knowledge of Erie's political and physical landscape and public processes. During his tenure on OSTAB, Jon actively participated in the writing and development of the Town's guiding documents. Jon authored the Open Space Chapter of the Comprehensive Plan which eventually was codified in the Town's Unified Development Code (UDC). Jon was the key commenter on the content, analysis and synthesis of the of the Open Space and Trail Chapters and Mapping that was adopted with the Town's first Parks Recreation Open Space and Trails Master Plan (PROST). Jon guided the process used in the development of the Erie Natural Areas Inventory (ENAI) to identify and design a habitat condition, quality and restoration rating and ranking system of significant natural areas throughout the Town's 49-square mile planning area.

- **Uncompahgre River Corridor Master Plan, Montrose, CO** – Jon was responsible for the development of an ecological master plan focusing on the Uncompahgre River as a natural asset for eco-tourism and the generation of riverfront economic development. Mr. Dauzvardis was responsible for assessing the character, condition and quality of aquatic, wetland and riparian habitat; and developing a rating, ranking, land acquisition prioritization system, and associated mapping aimed at the preservation and integration of open space and habitat within the City's parks, recreation and trail system.
- **Ruby Pipeline Wetland, Riparian and Waterbody Mitigation and Restoration Plan, WY, UT, NV and OR** – Jon was responsible for assisting with the generation of a Comprehensive Wetland Mitigation Plan outlining Clean Water Act regulatory guidelines, requirements, and processes. Jon developed an eco-region specific restoration plan for a 675-mile natural gas pipeline specifying the basis of design, construction, revegetation, maintenance, performance criteria, and monitoring means and methods for restoring approximately 460 acres of temporarily impacted riparian and wetland habitat.
- **Dry Creek Regional Urbanization Area, Weld County, CO** – Mr. Dauzvardis performed an ecological inventory and prepared the assessment report for a 6,000-acre Regional Urbanization Area (RUA); and a1000-acre multi-use site development in un-incorporated Weld County. Subsequent phases included establishing ecological policy, goals, and objectives for the study area that will assist the County in the refining their first ever Comprehensive Plan.
- **City of Broomfield I-25 Subarea Environmental Guidelines, Broomfield, CO** – Jon drafted development sensitivity design and ecological sustainability standards.
- **McStain Development Corporation, Mountain Village III Master Plan, Loveland, CO** – Conducted concept planning for recreational and environmental interpretation facilities focusing on lake and wetland habitat features of the community.
- **Estes Park Comprehensive Land Use Plan, Estes Park, Larimer County, CO** – Teamed with town planning staff in producing a county-wide land use plan using GIS as a public involvement/participation tool.
- **San Miguel River Park Corridor Master Plan, Telluride, CO** – Prepared park, trail, wetland and riparian corridor master plan and design for the San Miguel River Park Corridor. Jon prepared illustrative plan graphics that assisted the Town in applying for and winning approximately $500,000 in Natural Resource Damage Assessment Fund money from the State of Colorado, which was used for final design and implementation.
- **South Platte River Wildlife and Recreation Corridor Plan, Denver, CO** – Designed the Zuni Riverfront Park and planned the wildlife and recreation corridor between I-25 and 8th Street near Mile High Stadium. Prepared, steered and presented graphics that the City and County of Denver Mayor's Commission (Wellington Webb) and the Urban Drainage and Flood Control District used to help sell the project to the public and federal funding sources in Washington D.C.
- **Historic Arkansas River Walk, Pueblo, CO** – Coordinated and steered the design and presentation of riparian, aquatic, and palustrine wetlands in the HARP Natural Area. Designed environmental Education Park to include outdoor classroom, access, and multi-thematic interpretive nodes.
- **Pueblo Natural Resources and Environmental Education Council Plan, Pueblo, CO** – Designed the identity and jointly produced strategic natural resource based environmental education plan for Pueblo County (PNREEC). The plan helped build consensus among multiple private and governmental agencies and stakeholders on funding, conservation, restoration, and enhancement priorities throughout the County.
- **Aluminum Company of America (ALCOA) Huisache Cove Master and Design Plan Master of Landscape Architecture Thesis, Port Lavaca, TX** – Served as environmental consultant in researching and generating wildlife habitat restoration plan and multi-functional landfill cap redesign incorporating

coastal prairie, lacustrine, palustrine, estuarine wetlands, passive recreation, bird watching and ecological interpretation facilities on an industrial superfund clean-up site.

Aquatic, Wetland, and Riparian Habitat and Mitigation Design:

- **Big Thompson River Flood Recovery and Restoration, Loveland, CO -** ecos is currently part of a multi-disciplinary team assisting the Big Thompson Watershed Coalition (BTWC) with assessment, design, and construction of the Big Thompson between Rossum and Wilson Drives which are majority-owned by the City of Loveland and Loveland Ready-mix. As with all the flood recovery projects ecos has worked on, Jon produced 30%, 60% and 100% design plans, construction cost estimates, and specifications guiding soil development/enrichment; upland, riparian, and wetland seeding and planting; and numerous bioengineering techniques aimed at restoring the river and making it more resilient to future flood events. This project is aimed at completion in the summer of 2019.
- **Saint Vrain Creek Reach 3 Flood Recovery and Restoration, Boulder County, CO** - ecos is part of the multi-disciplinary team assisting Boulder County Parks & Open Space (BCPOS) with resilient design for the restoration of Reach 3 of the Saint Vrain Creek (from Highway 36 downstream to Hygiene Road) that was damaged by the 2013 floods. Jon's role in the project includes: 1) desktop and field assessment to inventory and document the characteristics of the stream reach and riparian corridor (e.g. in-stream features, vegetation, wildlife habitat); identify and locate significant habitat features within the areas of proposed construction; identify potential sources of native plant materials for restoration; and identify areas of opportunity within the reach that require native vegetation, wetland, PMJM, leopard frog and fishery habitat restoration; and delineate wetland habitat and waters of the U.S. in all areas of proposed/potential construction-related impact; 2) vegetation community and wildlife habitat restoration design; 3) permitting and compliance under the CWA, ESA and NHPA; and 4) construction oversight of restoration construction activities. This project was completed in the summer of 2018.
- **Bohn Park Flood Recovery and Restoration, Town of Lyons, CO** – ecos is part of the Design Team assisting the Town with the restoration, enhancement and stabilization of Bohn Park which was damaged by the 2013 floods. Ecos role is to assess, design, and prepare design-bid-build specifications for the natural restoration of the vegetation communities and habitat along South St. Vrain Creek that have been incorporated in to the landscape architecture of Bohn Park, the Towns largest and most used recreational asset. This project was completed in the spring of 2018.
- **Fourmile Creek Flood Recovery and Restoration, Boulder County, CO** – ecos was part of the Fourmile Watershed Coalition design-build team tasked with restoring flood-damaged properties that were prioritized in the watershed master plan. Jon generated seeding and planting plans, performance notes, cost estimates, and co-managed construction oversight in collaboration with the executive director of the Watershed Coalition. This project was completed in the summer of 2017.
- **James Creek Post-flood Restoration, Lefthand Watershed Oversight Group (LWOG), Jamestown, CO –** ecos was part of the LWOG Team responsible for preparing the 30-60% design package for James Creek Reach 16 as identified in the Lefthand Creek Watershed Master Plan. ecos performed pre- and post-flood plant community assessment; developed revegetation goals and objectives, the basis of design, monitoring protocols, and revegetation plans according to Colorado Department of Local Affairs, Community Development Block Grant – Disaster Recovery 30% Guidelines. Specific resources and issues of concern addressed by ecos, included federal and state listed candidate, threatened and endangered species, wildlife species of concern (including raptors), fisheries and fish passage, native plant communities, and management of noxious weeds.
- **Saint Vrain Creek Flood Recovery and Restoration, Town of Lyons, CO –** ecos is part of a design-build team tasked with restoring the St. Vrain Creek corridor in the Town of Lyons that was damaged during the September 2013 flood event. The goal of the project is to work with the Town and affected land-owners to create a more resilient floodplain and natural channel condition that will help alleviate future threats to the community, reestablish floodplain connectivity, stabilize banks, and restore aquatic, wetland and riparian habitat that was wiped out during the flood. Mr. Dauzvardis is responsible for developing the plant communities and revegetation strategies needed to restore aquatic and riparian structure and functions within the corridor that support fish, wildlife, recreation, and help the Town regain the ecological benefits and economic value they receive from outdoor enthusiasts. This project was completed in the summer of 2016.

- **Plum Creek Mitigation Bank, Sedalia, CO –** ecos was retained by Restoration Systems to prepare conceptual design plans for the Plum Creek Mitigation Bank Site that is currently under consideration by the Chatfield Reservoir Mitigation Company (CRMC). The purpose of the Site is to provide compensatory mitigation credits for unavoidable, permitted impacts to wetland, PMJM and bird (target resources) habitat regulated under the CWA and ESA; and to restore, enhance and preserve natural resource functions. Jon has guided agency and CRMC staff on tours of the Site; performed plant community mapping, baseline EFU assessment for PMJM, and FACWet assessment of wetlands. Jon was responsible for mapping, interpretation, and quantification of historic and existing habitat on the site. Jon prepared Conceptual Design Plans for resource mitigation including channel geomorphology, PMJM and wetland habitat setting the stage for post-mitigation calculations of EFU's.
- **Bellvue Raw Water Ponds Riverbank Restoration, Bellvue, CO –** The 2013 flood on the Poudre River altered the course of the river and severely eroded a bank nearly causing a breach of the City of Greeley's raw water ponds – their main municipal water supply. The goal of the project was to stabilize the bank to protect the ponds and to create riparian habitat for the Preble's meadow jumping mouse, a federally listed threatened and endangered species. Jon was responsible for preparing bioengineering design plans and specifications that include soil/cobble encapsulated lifts, stream barbs to deflect flows away from the bank, and harder, biotechnical design of soil/riprap and stream bed scour protection measures to prevent erosion and further undermining and sloughing of the bank. Design plans included specification of native plant materials and various techniques to restore cottonwood forest and willow habitat to further stabilize the bank.
- **Poudre River Pipeline Crossing at Kodak, Windsor, CO –** Jon's role on the ecos team was to assess restoration potential, techniques, and prepare design plans and performance specifications to reclaim a pipeline corridor across the lower Poudre River where the City of Greely had to replace 3 major water supply lines. Flooding on the Poudre River in 2013 and 2014 temporarily suspended construction of the pipeline. Jon will oversee site stabilization and restoration measures once all 3 pipelines have been installed.
- **Lions Park Poudre River Restoration Plan, Laporte, CO –** Jon's role on the ecos team was to assess habitat conditions; gather, compile and analyze field survey data; and to prepare the mapping and mitigation design plans for the Lions Park PMJM habitat and the Poudre River Bank Stabilization Plans. Jon simultaneously designed and executed the technical drawings for the structural components of the habitat, ensuring that the proposed riparian plant community, habitat structures (brush piles), and bioengineered streambank stabilization measures will create the conditions that alleviate the current habitat fragmentation; support the life requisites of the PMJM; and enhance the overall health of the Poudre River fishery.
- **St. Vrain River Riparian Corridor Enhancement, Lyons, CO –** Jon designed, managed and led the construction of the Preble's Meadow Jumping Mouse Habitat (PMJM) enhancement project along the St. Vrain River. Jon worked in coordination with the project sponsor and Director of the Town of Lyons, Parks, Recreation and Cultural Events Department to implement required mitigation within a passive greenway park along the St. Vrain. Jon's role included riparian/PMJM mitigation site identification and habitat assessment; and design; and implementation of riverbank stabilization and riparian habitat enhancement measures.
- **Brush Creek Fishery Enhancement Plan, Saratoga, WY** – Prepared access, staging and design plans, details and performed on-site construction oversight of instream and riparian habitat enhancements and bioengineered bank stabilization along a 3-mile reach of Brush Creek. The purpose of the project is to enhance fish, bird and wildlife habitat and use these resources to facilitate education and improve the recreational experience of Ranch guests. Access routes were planned so that they can be easily converted to trails to avoid repetitive impacts to high quality habitat and productive pastures.
- **St. Vrain River Riparian Corridor Enhancement, Lyons, CO** – Jon is the lead Landscape Architect for the restoration and enhancement of Preble's Meadow Jumping Mouse Habitat (PMJM) along the St. Vrain River. Jon and ecos are working in coordination with the Town of Lyons, Parks, Recreation and Cultural Events team to implement this restoration project within a passive park area along the St. Vrain. Jon's tasks include riparian/PMJM habitat assessment; PMJM site location and habitat design; and implementation of riverbank stabilization and riparian habitat enhancement measures.
- **TZ Ranch, Elk Hollow Creek Fishery Habitat Enhancement Plan, Saratoga, WY -** ecos performed the assessment and design of the Elk Hollow Creek Project, which included instream and riparian habitat

improvements aimed at increasing bank stability, improving aquatic habitat and angling opportunities, and providing long-term stability to the reach. Instream improvements included drop structures, plunge pools, deep pools, riffles and spawning habitat. Bank improvements included seeding and planting plans for native wetland and riparian species. Jon was the lead on the generation of design-build plans and provided construction oversight of instream structure and native plant installation.

- **Brush Creek Ranch Pond Creation Plan, Saratoga, WY** – Prepared below grade pond excavation, grading, drainage and revegetation plan for a 0.30-acre fishing pond, followed by on-site field layout and surveying, wetland sod transplanting, submerged aquatic habitat and construction support of heavy equipment operators. The pond was designed to be a self-sustaining, cold water fishery that supports all components of the aquatic food-chain and incorporates all necessary life requisites for trout; and provide fishing opportunities during high water in Brush Creek.
- **Edwards Eagle River Restoration Project, Edwards, CO** – Assessment, planning, native plant community design and construction oversight of aquatic, wetland, riparian habitat along 1.5 mile reach and 168-acres of floodplain along the Eagle River utilizing indigenous materials and methods that naturally integrate habitat structure in the landscape context. Planning and design included trails, boat launch, boardwalks, overlooks, and interpretive sign systems and thematic content.
- **Boone Property, Boulder Creek Fishery Enhancement Project, Boulder, CO** – Performed site assessment and identified instream and overhead cover habitat to enhance fish habitat along a short reach of Boulder Creek adjacent to City of Boulder, Eldorado Canyon Open Space.
- **C-Lazy-U Ranch Willow Creek Fishery Enhancement Plan, Granby, CO** – Assessed and prepared design plans for 2 miles of instream and overhead cover habitat aimed at enhancing water quality through increased bank stability, improving aquatic habitat and angling opportunities, and providing long-term stability to the reach influenced ongoing ranching activities. Bank-side improvements include detailed seeding and planting plans indicating site-specific plant and seed locations, life zones, and species palettes according to hydrologic, soil, and aspect conditions.
- **Colowyo Coal Mine Wetland Creation Plan, Meeker, CO** – Performed wetland mitigation site feasibility assessment and design of 2.2-acres of created wetland benches along a 1.5-mile reach of the West New Goodspring Creek.
- **Uncompahgre River Wetland Creation and Streambank Stabilization, Montrose, CO** – Mr. Dauzvardis developed a Clean Water Act Individual Section 404, alternatives analysis and mitigation plans that successfully defrayed public descent and offset unavoidable impacts related to the River Landing Retail Development Project. Once approved by the USACE, the project turned a degraded, gravel-mined portion of the floodplain into functional and aesthetic riparian habitat that is now enjoyed by the public via a segment of trail that Mr. Dauzvardis designed. Two acres of riparian and "backwater" wetland habitat were strategically created along the Uncompahgre River to ensure reliable hydrologic connectivity and support of the designed wetland plant community. Nearly 350 lineal feet of severely degraded stream bank was stabilized using a naturalized bio-engineering approach that incorporated soil, native seed, erosion control blanket, shrubs, trees, and strategically located river boulders and logs to restore the riparian habitat, create fish habitat and redirect scouring flows away from the once barren bank.
- **River Point at Sheridan Brownfield Redevelopment, Sheridan, CO** – Designed and oversaw the construction of a "bio-engineered" and "bio-technical" vegetative landfill cap system and water quality swale that drains to the South Platte River. Jon was responsible for integrating the swale in to the River Point at Sheridan commercial redevelopment and the City of Englewood Golf Course renewal – renamed to the Broken Tee Golf Course.
- **Broken Tee Golf Course Flood Protection, City of Englewood, CO –** Oversaw the construction of a biotechnical subsurface stabilization and flood protection system (under-armor) designed to ensure that the woodland golf course tees, fairways and greens in the South Platte River floodplain are not compromised by flood scour. Designed and implemented bioengineered bank stabilization and under-armor on Bear Creek that was essential for protecting tees and greens. Jon was responsible for disproving the jurisdictional status of artificially supported wetlands via a groundwater monitoring system.
- **Lafarge Northbank Resources Gravel Pit Wetland Design, Rifle, CO** – Jon asses DMG requirements and prepared gravel pit reclamation plans aimed at providing suitable shallow-water wetlands and islands within the pit closure area to serve as compensatory mitigation for wetland impacts associated with mine operations adjacent to the Colorado River.

- **Leach Creek Stream Enhancement, Grand Junction, CO** – Designed stream corridor enhancements for a ½-mile section of Leach Creek that was channelized and used as an irrigation canal. Enhancements were designed to restore natural channel form and function, improve the aquatic environment, and provide mitigation for jurisdictional impacts permitted under the Nationwide Permit program. This project is being used as a model and replicated along other reaches of Leach Creek
- **Castro Property Wetlands and Wildlife Ponds, Beulah, CO** – Performed the site assessment, feasibility analysis, water resource and minor dam design, native plant design, landscape architecture, and supported the water rights application needed to create shallow water wetland habitat for amphibians, waterfowl, migrating bird and ungulates, and deep water habitat for trout at a sub-alpine elevation of 9000 feet. Project included development of a spring, creation of a creek and a mechanical water circulation and aeration system to support the aquatic, wetland, and riparian ecosystem. Organized, supervised and participated in a volunteer planting effort.
- **Jefferson County Gunbarrel Bridge Replacement, Oxyoke, CO** – Developed construction plans and specifications and oversaw construction of wetland and Preble's mouse habitat mitigation to enhance weedy and degraded wetland and Preble's mouse habitat along Gunbarrel Creek, a tributary to the upper South Platte River near Deckers, CO.
- **Coal Creek Bank Stabilization, Erie, CO** – Assessed, permitted, designed and performed construction oversight of bio-engineered/bio-technical bank stabilization and wetland creation associated with the Vista Parkway bridge crossing over Coal Creek in Erie, CO. The project involved pulling back vertical banks and restoring native wetland, riparian, and short grass prairie habitat.
- **Spring Creek Wetland Mitigation, Colorado Springs, CO** – Generated wetland and creek creation plans that integrated required mitigation into a high density, "new urban" development. The design emphasized re-utilization of urban storm water to sustain wetlands, use of indigenous plants, construction materials, and natural geomorphic relationships.
- **Sulphur Gulch, Parker, CO** – Developed a naturalized sculpted concrete drop structure design, planting and bio-engineering plans for a highly visible, urbanizing reach of a sandy creek through the center of the Town of Parker.
- **Skylark Creek Restoration Plan, Kremmling, CO** – Designed and performed construction oversight of aquatic, wetland and riparian plant community, and trail system along a historic side channel of the Upper Colorado River on a private fishing ranch.
- **ARCO Opportunity Ponds Wetland Mitigation Design, Anaconda, MT –** Jon generated the design of a 908-acre complex of wetlands and terrestrial habitat required to meet the Consent Decree and the functional assessment criteria established during the wetland assessment process mentioned previously. The design is currently being implemented. Once complete, the grading, drainage, hydrology, and revegetation strategy used to create wetlands from massive soil borrow pits will potentially be the largest inland, freshwater wetland mitigation project in the United States.
- **Northgate Boulevard Realignment, Colorado Springs, CO** – Coordinated and prepared ESA Section 7 and CWA Section 404 consultation documents as required by the USFWS and USACE, including mitigation construction documents, specifications, on-site layout of plant communities and construction supervision aimed at restoring wetland and riparian habitat occupied by Preble's meadow jumping mouse.
- **Northgate PMJM and Wetland Mitigation Plan, Colorado Springs, CO** – Mr. Dauzvardis was an instrumental member of multidisciplinary team responsible for delineating wetlands, preparing ESA Section 7 and CWA Section 404 assessment, impact analysis and consultation documents as required by the USFWS and USACE. As the lead designer, Jon was responsible for the design of over 80 acres of wetland, riparian, and grassland habitat utilized as primary and secondary habitat for Preble's Meadow Jumping Mouse, a Federally-listed threatened species. Jon prepared mitigation construction documents, specifications, onsite layout of plant communities and supervised construction for this precedent setting mitigation plan designed to offset impacts to critical habitat over a 1200-acre site.
- **Martin County Coal Corporation, Inez, KY** – Mr. Dauzvardis bioengineered and performed on-the-ground triage of two stream corridors, consisting of 26 miles, impacted by a coal slurry spill that originated from a mountaintop mine reservoir used to hold liquefied coal dust. Jon identified and documented critically imperiled stream banks and human settlements, and then designed, coordinated, led and supervised local crews during the implementation of specified floodplain, bioengineered bank stabilization, and reforestation efforts.

- **Uncompahgre River Restoration and Park Corridor, Ouray, CO** – Jon designed and performed construction oversight of the restoration and reclamation of one mile of upland, riparian and wetland habitat left barren by historic placer mining. The major challenge presented by this project was a lack of soil, organic matter and nutrients to sustain vegetation. This constraint was addressed by amending the soil with humate and planting and seeding riparian vegetation to initiate natural succession and bioaccumulation of matter, assisted by an irrigation system that injected organic fertilizer and microbes (mycorrhizea) in to the substrate.
- **Burlington Mine Remediation, Jamestown, CO** – Preparation and management of specification package, best management practices (BMPs), and revegetation design for mine waste capping and closure.
- **Powder River Coal Company – Porcupine Creek Restoration, Douglas, WY** – Designed and supervised the construction of this post mine wetland/creek restoration project. Following the pit closure, reclamation specialists reestablished the original location and geomorphic relationships of the creek using historic aerial photography using a trapezoidal channel cross-section design. Jon adapted the design creating grading and wetland planting plans that mimic the landform, natural lateral and longitudinal channel tilt, and plant communities that are indigenous to ephemeral creeks in the shortgrass prairie landscapes of eastern Wyoming.
- **Sand Creek Corridor Habitat Enhancement at Bluff Lake, Denver, CO** – Prepared plant community, bioengineering and bank stabilization design. Prepared visualization graphics to present and receive design approval.
- **Intrawest Resort Development, West Ten Mile Creek, Copper Mountain Village, CO** – Prepared vegetation community and concept design of village base streamside recreational amenities.

Construction and Plant Installation:

- **St. Vrain River Riparian Corridor Enhancement, Lyons, CO –** Jon managed construction and implementation of the restoration and enhancement of 0.60-acre of riparian Preble's Meadow Jumping Mouse Habitat (PMJM) along the St. Vrain River.
- **Standley Lake Protection Project, Westminster, CO** – Designed and supervised construction of a 0.50-acre created emergent wetland to fulfill final mitigation requirements of the USACE and bring closure to the City's drinking water protection project.
- **Caribou Peat Bog Restoration, Nederland, CO** –Prepared native plant community design, planting cost estimate, and on-the-ground oversight of volunteers to restore a high-altitude peat bog disturbed by an illegal four-wheel drive "mudfest".
- **Department of Energy (DOE) Wetland Mitigation Bank, Westminster, CO** – Construction supervision of grading and planting plans of a 12-acre wetland mitigation bank design for the Department of Energy.
- **ARCO Lower Area One and Butte Reduction Works, Butte, MT** – Performed construction observation and supervision of temporary labor crews to plant a passive treatment wetland designed to absorb heavy metals from groundwater.
- **Colorado Department of Transportation Mitigation Bank, Limon, CO** – Performed in-field planting design and supervised local labor to complete a 10-acre wetland mitigation bank designed by CDOT to offset future wetland impacts in the transportation region.
- **Irvine Ranch Water District – San Joaquin Wetland Treatment System, Irvine, CA** – Planting superintendent of a wetland designed to be a used as tertiary wastewater treatment facility and waterfowl refuge.

PRESENTATIONS & INSTRUCTION:

Dauzvardis, Jonathan B. 2008. Preserving the Ecological Services of Willow Cuttings. Research presented at the Colorado Riparian Association (CRA) Sustaining Colorado Watersheds Conference. October 2, 2008. Vail, Colorado.

Dauzvardis, Jonathan B. 2006. Water Pollution and Wetland Plant Tolerance to Various Ph Levels. Classroom instruction with Elementary Students. Flagstaff Academy Charter School. February 2, 2006. Longmont, Colorado.

Dauzvardis, Jonathan B. 2006. Soil Erosion and Habitat Destruction. Classroom instruction with Elementary Students. Flagstaff Academy Charter School. January 26, 2006. Longmont, Colorado.

Dauzvardis, Jonathan B. 2004. Wetland and Wildlife Habitat Restoration, Opportunity Ponds, Anaconda, Montana. Poster Presentation at Ecological Restoration Conference. October, 2003. Orlando, Florida.

Dauzvardis, Jonathan B. 2003. Application of Landscape Ecology Principles to Mine Remediation and Wetland Creation: An Ecological Restoration Seminar using a Case Study of the Opportunity Ponds Wetlands Plan, Anaconda, Montana. Presented at the University of Colorado, Denver. November, 2003. Denver, Colorado.

Dauzvardis, Jonathan B. 2000. Endangered Species Act Issues: Incorporating the ESA into Mitigation Projects. Presented at the Continuing Legal Education (CLE, International) Colorado Wetlands Conference. September 18, 2000. Denver, Colorado.

AWARDS:

- Colorado Landscape Contractors Award, Sand Creek Enhancement Project – 2000
- Colorado Landscape Contractors Award, Skylark Creek Restoration Project – 1998
- Colorado American Society of Landscape Architects, Research, and Communications – 1997
- Texas American Society of Landscape Architects Honor Award – 1995
- Texas A&M Landscape Architecture Faculty Award – 1995

PROFESSIONAL ASSOCIATIONS:

- Town of Erie, Colorado Open Space and Trails Advisory Board (OSTAB) - As a former member and chair of the Town of Erie Open Space and Trails Advisory Board (OSTAB), Mr. Dauzvardis routinely collaborated with Town Administrator, Community Planning, Public Works, and Parks and Recreation Directors and Staff, and advised the Board of Trustees on all matters related to the goals, objectives, prioritization, acquisition, conservation, and the management of open space and trails throughout a 49-square mile planning area. Jon's 8-year experience on the OSTAB translates to an intimate knowledge of public processes.
- Society of Wetland Scientists (SWS)

ecos ecosystem services LLC

RESUME

Grant E. Gurnée, P.W.S.

Owner/Managing Partner
Senior Restoration Ecologist
Fisheries and Wildlife Biologist
Wetland Ecologist

AREAS OF EXPERTISE:

- Project Management for Complex, Environmental Regulatory and Restoration Projects
- Habitat Assessment, Surveys, Planning, Permitting, Restoration Design, Construction Oversight & Monitoring for:
  - Aquatic, Wetland and Riparian Habitat, and Wildlife Habitat
  - Threatened & Endangered Species, Special Status Species, and Species of Concern
  - Nesting Birds & Raptors
  - Natural Areas, Open Space, Trails and Environmental Education Facilities
  - Conservation and Resource Mitigation Banks
- Natural Resources/Environmental Regulatory Compliance
- Construction Oversight & Best Management Practices
- Grant Funding Support for Conservation and Restoration Projects
- Expert Witness Testimony

EDUCATION:

- MCRP, Environmental Planning and Law Program, Rutgers University, 1994
- Bachelor of Science, Biology, Richard Stockton College of N.J., 1984

EMPLOYMENT HISTORY:

- 2008-Present: Owner, Managing Partner and Senior Restoration Ecologist
  Ecosystem Services, LLC, Erie, Colorado
- 1999-2011: Ecological Restoration Group Manager
  Walsh Environmental Scientists and Engineers, LLC, Boulder, Colorado
- 1994-1999: Vice President and Consulting Division Manager
  Aquatic and Wetland Company, Boulder, Colorado
- 1987-1994: Ecological Assessment Group Manager
  Killam Associates, Millburn, New Jersey
- 1989 – 1994: Owner and Ecologist, Westhill Environmental, Colonia, NJ
- 1986-1987: Project Manager, Connolly Environmental, Denville, New Jersey
- 1985-1986: Biological Technician/Team Lead, EA Engineering Science and Technology, Forked River Field Station, New Jersey

CONTINUING EDUCATION:

- Stream Functions Pyramid Workshop, Denver, CO - 2014
- Colorado Natural Heritage Program, Wetland Plant Identification - 2014
- Colorado Natural Heritage Program, Ecological Integrity Assessment for Colorado Wetlands - 2013
- FACWet – Functional Assessment of Colorado Wetlands - 2010, 2012 and 2013
- Natural Treatment System Design and Implementation, Southwest Wetlands, Phoenix, AZ - 1995
- Continuing Education in Coastal and Wetland Ecology, Rutgers University, 1985 – 1994

1455 Washburn Street Erie, CO 80516 (p): 970-812-3267 (e): grant@ecologicalbenefits.com

CERTIFICATIONS:

- Professional Wetland Scientist, Certification (#559), Society of Wetland Scientists Certification Program, 1995
- Certified Wetland Delineator, Army Corps of Engineers Wetland Delineator Certification Program, 1993
- Wetland Mitigation Planning and Design Certification, Environmental Concern, Sparks, MD, 1992
- Certified Ornithologist, Marine Biologist, Aquatic Biologist and Ecologist for the preparation and certification of Environmentally Sensitive Areas Protection Plans, N.J. Dept. of Environmental Protection and Energy, 1988
- Wetland Delineation and Regulatory Certification, National Wetland Science Training Institute, 1988

PROTECTED SPECIES SURVEYS AND HABITAT ASSESSMENTS:

- Ute-ladies' tresses orchid and Colorado butterfly plant
- Preble's meadow jumping mouse
- Nesting birds and raptors, including burrowing owls
- Swift fox and bobcat
- Boreal toad
- Pine Barrens and grey tree frogs
- Freshwater, estuarine and marine surveys for native fish
- Western Tiger Salamander
- Terrestrial and sea turtles

EXPERIENCE SUMMARY:

Mr. Gurnée is a founder and managing partner of Ecosystem Services, LLC (ecos), a design-build, ecological planning and design firm that is the culmination of his life's work and passion for restoring and conserving the natural world. Grant is a certified Professional Wetland Scientist with over 35 years of experience in wetland ecology, restoration ecology, wildlife and fisheries biology, environmental planning, and regulatory compliance. Prior to ecos Grant established the Ecological Restoration Group at Walsh Environmental and was the Vice President in charge of the Consulting & Design Division for Aquatic and Wetland Company, the first design-build-grow firm in Colorado. Mr. Gurnée utilizes his diverse field assessment and hands-on experience to bring a unique and pragmatic, big-picture perspective to projects from conceptual planning through implementation. Grant's environmental planning and law education combined with his regulatory compliance experience make him one of the leading experts in the Intermountain West in Clean Water Act and Endangered Species Act issues. He enjoys teaching and furthering the science and art that comprise the field of restoration ecology. As such, Grant has published and presented papers and technical manuals, and lectured nationally and internationally at educational programs that further the understanding of aquatic, wetland, riparian and T&E species habitat assessment and restoration. Mr. Gurnée has also been called upon to provide expert reports, expert witness testimony and liaison representation in complex regulatory compliance matters.

RELEVANT PROJECT EXPERIENCE:

The following is a sampling of select projects and clientele that Grant has successfully completed or is currently involved in:

Habitat Assessment and Regulatory Compliance

- **Banning Lewis Ranch, Colorado Springs, CO** – ecos was hired by Norwood Homes to perform a Preliminary Habitat Assessment (PHA) for the Banning Lewis Ranch (BLR), an 18,000-acre property within El Paso County, Colorado that will double the size of Colorado Springs once it is developed. The PHA included an assessment and mapping of vegetation, noxious weeds, Federal and State Listed Candidate, Threatened and Endangered (T&E) Species, Wildlife Species of Concern (including Raptors), Waters of the U.S. and Wetland Habitat, Floodplains, and Cultural, Archeological and Paleontological Resources. The PHA Report summarizes ecos' Site assessment findings and includes the mapping of all ecological constraints and cultural resources, a preliminary jurisdictional status determination of all potential wetland habitat and waters of the U.S. (WOUS) under the Clean Water Act (CWA), a summary of ecological opportunities and constraints, and provides regulatory guidance to assist in planning and implementing the future development of the BLR. Norwood and their planning team, in association with ecos, are currently uploading and interpreting all of the ecos Site assessment mapping into their base GIS layers to inform

future site planning and recommend proactive measures to conserve wildlife and wetland habitat, pristine prairie and ephemeral creeks, floodplains, and significant cultural resources.

- **Clean Water Act Jurisdictional Assessment of El Guique Mine in Estaca, New Mexico –** Ecos assisted Espanola Transit Mix, LLC (ETM) in their assessment at the El Guique Mine in Estaca, New Mexico (Site) by determining the potential jurisdictional status of onsite drainages and other waters under the CWA. We reviewed available background information and base mapping to gain a better understanding of the Site and the adjacent offsite area and prepared an overlay of potential WOUS on Google Earth aerial Imagery for mark-up and notation in the field. Ecos then conducted a field assessment to review Site conditions, and potential offsite, downstream connections to WOUS, and particularly the presence of a Significant Nexus to the Rio Grande, a TNW. We drafted a Technical Memorandum summarizing the methodology employed, the results of the field assessment, the rationale under the CWA for all areas deemed to be excluded or non-jurisdictional and illustrated the locations of potential jurisdictional and non-jurisdictional features identified in the field on Google Earth aerial imagery.
- **Bellvue Pipeline Project, BMP Facilitator, Larimer County, CO** – ecos was retained by the City of Greeley as Best Management Practices (BMP) Facilitators to provide pre-construction documentation post-construction oversight of pipeline reclamation processes. Essential responsibilities include meeting with landowners prior to construction to facilitate project understanding and post-construction outcomes; to document landowner needs and wants relative to project goals and land use; to document and monitor pre- and post-construction reclamation and maintenance requirements; and to ensure the contractors maintain compliance with all state and federal laws, county regulations, and Greeley construction and restoration specifications.
- **Encana Oil and Gas (USA), Denver Julesburg Basin, CO** – Encana hired ecos to assess their ecological constraints, recommend means and methods to avoid, minimize and permit unavoidable impacts; and to mitigate, restore and prepare ecological management plans for their drilling and pipeline operations in the Denver Julesburg basin. Grant's role on the team is to perform site assessments, research background data, and prepare assessment reports and mapping data that can be utilized by Encana's project managers to proactively track ecological resources before issues arise. In addition to client consultation, Ecos is responsible for tracking drill site schedules, constraints, restoration and management efforts in a data base and reporting said information to Encana's project manager on a regular basis.
- **Georgetown Lake, Georgetown, CO** –ecos was hired to perform an onsite assessment of ecological resources and prepare a summary report to describe the physical/ecological characteristics of the Project area and evaluate the potential effects of the construction of a loop trail project on environmental issues and species of concern to support a GOCO grant application. Items evaluated and documented, include site location/ownership, general site characteristics, current land use, proposed impacts, possible effects on Federal– and State-listed T&E animal and plant species, unique or important wildlife, water quality, water bodies, wetlands, and floodplains, stormwater runoff, sedimentation, soil erosion, and invasive species. The assessment report also included mitigation measures, project benefits, and environmental compliance recommendations under applicable regulatory programs.
- **Site Assessments for General Vegetation Cover and T&E Species Presence/Absence** – ecos was retained by JADE Consulting, LLC to perform the assessment of two future development sites located in Lafayette and Yuma, Colorado. We performed a desk-top assessment to identify existing site characteristics and screen the potential presence/absence of federally-listed threatened and endangered (T&E) species and followed up with onsite assessments to verify our preliminary findings. Our findings and recommendations were summarized in a Technical Memorandum in which we determined that no further assessment or regulatory compliance actions are required.
- **The Cove Assessment & Regulatory Compliance Report, El Paso County, CO** - ecos was retained by Lake Woodmoor Development, Inc.to perform a natural resource assessment for The Cove development, and to prepare a Natural Features Wetland, Wildfire, Noxious Weeds & Wildlife Report (Report) pursuant to El Paso County environmental review regulations. The purpose of the project was to identify and document the natural resources, ecological characteristics and existing conditions of the Site; identify potential ecological impacts associated with Site development; and provide current regulatory guidance related to potential development-related impacts to natural resources, including: Mineral and Natural Resource Extraction; Vegetation; Wetland Habitat and Waters of the U.S.; Noxious Weeds; Wildfire Hazard; Wildlife; Federal and State Listed Candidate, Threatened and Endangered Species; and Raptors and Migratory Birds.

- **Jurisdictional Determination Request for Banning Lewis Ranch, Villages 1 and 2 Residential Development, El Paso County, CO** - ecos was retained by Oakwood Homes, LLC to review a 2014 Jurisdictional Boundary Delineation and determine if a portion of the wetlands and waters within the site could be deemed non-jurisdictional under the Clean Water Act (CWA) based on their "isolated" status. Following data review, ecos arranged a field assessment with the U.S. Army Corps of Engineers (Corps) to review site conditions, and potential offsite, downstream connections to waters of the U.S. (WOUS), and particularly the presence of a Significant Nexus to Traditional Navigable Waters TNW). Ecos and the Corps agreed that several of the intermittent drainages on the suite are not jurisdictional under the CWA, as they are not: 1) a TNW or wetland adjacent to a TNW; 2) a Relatively Permanent Water (RPW) or a wetland directly abutting an RPW with perennial or seasonal flow; 3) a tributary to a TNW; or 4) a direct tributary to a downstream WOUS as the feature loses it bed and banks. The Corps submitted ecos' findings to the U.S. Environmental Protection Agency (EPA) and they concurred and issued an Approved Jurisdictional Determination stating that the drainages were indeed "isolated" features exempt from the CWA.
- **Bellvue Pipeline Project, CWA and ESA Regulatory Negotiation, Larimer County, CO** – ecos assisted the City of Greeley from 2011 through 2014 in their negotiations with the Corps to facilitate review and verification of the Project under CWA, Nationwide Permit12 (NP12) in 2014. Grant aided the City during Corps meetings, field visits and teleconferences; in coordinating with the Corps and the technical experts on the Corps Common Technical Platform (CTP) team; and in utilizing the CTP Poudre watershed data to assess the probability of Project-specific impacts. Grant also provided regulatory and technical support to the City for the CWA, Pre-Construction Notification (PCN) Supplement for the Project from 2014 through the USACE's 2017 issuance of the "removal of capacity conditions for the Northern and Fort Collins segments" placed on the 2014 NP12. His tasks included performing Impact Avoidance Evaluations, providing historical context and data from the initial work performed for the City on this Project, assisting a Team of multi-disciplinary professionals in the preparation of Impact Assessment Reports, meeting with the City to discuss overall regulatory strategy, assisting with the preparation of the cover letter to transmit the PCN Supplement to the USACE, and assisting with discussions and presentations to the USACE during their review and processing of a Minimal Effects Determination for the Project.
  Mr. Gurnée also assisted Greeley in their negotiations with the FWS to facilitate review and consultation for the Northern Segment of the Project under Section 7 of the ESA. Grant led the field assessment with FWS, identification and prioritization of potential PMJM habitat mitigation sites, development of a conceptual design for the selected PMJM habitat mitigation sites, and preparation of the Biological Assessment Addendum and Habitat Mitigation Plan. Grant also aided the City during agency review and approval of the FWS Biological Opinion by utilizing his relationships with the FWS, and extensive experience of ESA regulations, policies and precedents.
- **Appraisal Support Documentation Report for the 1st Bank Parcel, Colorado Springs, CO** - ecos was retained by 1st Bank Holding Company to perform a Preble's meadow jumping mouse (PMJM) habitat assessment, mitigation cost analysis and conceptual lot layout for the approximate 9.4-acre 1st Bank Parcel (Site) situated south of the Gleneagle residential development and north of the current Northgate Open Space along Smith Creek in Colorado Springs, Colorado.
- **South Boulder Canon Ditch Maintenance, Clean Water Act (CWA) Exemption Determination, Erie, CO** – ecos assisted the Town of Erie in exempting their proposed ditch maintenance project by performing an assessment of site conditions, submitting the assessment report to the Corps, and verifying that said project is exempt pursuant to Section 404(f) of the CWA.
- **Endangered Species Act (ESA) Compliance Documentation for the Pinon Lake tributary CLOMR Application, Forest Lakes Filing 2B in El Paso County, Colorado** – ecos performed an assessment to document the absence of federally-listed T&E species and their habitat and prepared a report for FEMA that documents that the proposed CLOMR action will not result in a "take" of T&E species.
- **Gleneagle Infill Development Assessment & Regulatory Compliance Report, El Paso County, CO** - ecos was retained by G & S Development, Inc. to perform a natural resource assessment for the proposed Gleneagle Infill Development at the former Gleneagle Golf Course, and to prepare a Natural Features and Wetland Report (Report) pursuant to El Paso County environmental review regulations. The purpose of the project was to identify and document the natural resources, ecological characteristics and existing conditions of the Site; identify potential ecological impacts associated with Site development; and provide current regulatory guidance related to potential development-related impacts to natural resources, including: Mineral and Natural Resource Extraction; Vegetation; Wetland Habitat and Waters of the U.S.;

Weeds; Wildfire Hazard; Wildlife; Federal and State Listed Candidate, Threatened and Endangered Species; and Raptors and Migratory Birds. As part of the Project, ecos obtained an Approved Jurisdictional Determination from the Corps.

- **North Fork at Briargate Habitat Evaluation and ESA Compliance, Colorado Springs, CO** - ecos performed a habitat evaluation on behalf of High Valley Land Co., Inc. and La Plata Communities to support informal consultation with the U.S. Fish and Wildlife Service (FWS) under the ESA for potential effects to the Federally-listed, threatened PMJM from the proposed North Fork development, Filings 3 through 7 at Briargate.
- **C Lazy U Preserves Natural Resource Inventory and Conservation Easement Documentation, Grand County, CO** – ecos is assisting the C Lazy U Preserves in assessing and documenting the conservation values of the 980-acre site known as C Lazy U Preserves near Granby, CO such that the site may be protected under Conservation Easements (CE's) held by The Nature Conservancy. The purpose of the CE's is the long-term preservation of the scenic, open space, agricultural, significant natural habitat, native vegetation, rare plant communities, riparian, and wetland values of the Property. ecos staff completed the Easement Documentation Reports Phase 1 of the CE's in 2006, Phase 2 in 2007, and Phase 3 in 2015.
- **Seaman Water Management Project, Riparian-Wetland Technical Support -** Mr. Gurnée supported Greeley in the NEPA EIS process by reviewing riparian and wetland technical reports prepared by the Corps CTP team, and providing comments to assist the City in their formal review and response to the Corps. He also provided technical and regulatory support for CWA and ESA (PMJM habitat) assessment, consultation, and compensatory mitigation planning and design.
- **City of Louisville, City of Westminster, Jefferson County and Town of Monument** – ecos performed numerous wetland habitat, wildlife, MBTA and T&E species habitat ecological assessments, wetland delineations, and Clean Water Act Section 404 and Endangered Species Act Section 7 Permits and mitigation plans for counties, municipalities and quasi- municipalities, including Highway 42 and 96th Street realignment, Jim Baker Reservoir, Standley Lake Protection Project, Triview Metro District Preble's and wetland habitat mitigation planning.
- **ARCO Clark Fork River Basin Anaconda Smelter Superfund Site, Anaconda, MT** – Grant and his Team performed wetland delineation, functional assessments, and impact analysis over a 200 square mile area affected by historic mining practices and current remedial actions required by an EPA consent decree.
- **ARCO Clark Fork River Basin Milltown Reservoir Superfund Site, Missoula, MT** – Mr. Gurnée and his Team performed wetland delineation, functional assessments, and impact analysis of proposed remedial actions that will remove metal laden sediments from the site prior to dam removal.
- **C-Lazy-U and Horn Ranch Environmental Assessments, Granby, CO** – Mr. Gurnée and his Team performed an assessment of ecological opportunities and constraints in the aquatic, riparian, wetland and threatened and endangered species habitat along the Colorado River for the development and enhancement of fishing/resort ranch amenities.
- **Village at Avon, Avon, CO** – Grant and his Team performed a wetland delineation and prepared CWA Section 404 permitting for the town center expansion and low-density ranchette development.

Protected Species Surveys and Habitat Assessments

- **Golden Eagle Monitoring at Meadow Park in Lyons, CO** - ecos was retained by the Town of Lyons (Town) to perform the monthly monitoring of the Golden Eagle (*Aquila chrysaetos*) nest sites at Meadow Park, to prepare monthly Monitoring Summary Memorandum following each event, and to prepare and submit annual reporting to the U.S. Fish and Wildlife Service (USFWS) associated with the *Lyons Federal Fish and Wildlife Permit #MB82833B-0, Eagle Take Associated With But Not The Purpose Of An Activity* (Take Permit).
- **Nesting Birds, Raptors and Burrowing Owls** – Grant has completed over 100 pre-construction nesting surveys and numerous monitoring surveys for raptors and burrowing owls. His projects include pipeline rights-of-way, housing and commercial development projects, stream and river restoration projects, wind and solar farm projects, and oil and gas projects along the Front Range of Colorado, as well as projects in the Pine Barrens of southern New Jersey. His avian experience includes golden eagle nest monitoring; barred owl roost and nest monitoring, and call playback inventory; and multi-species raptor surveys.
- **Native Plants** - Grant has completed numerous pre-construction and monitoring surveys for Ute ladies' tresses orchid and Colorado butterfly plant since 1994. His projects include pipeline rights-of way, mined

land reclamation projects, housing and commercial development projects, stream and river restoration projects, wind and solar farm projects, and oil and gas projects along the Front Range of Colorado.

- **Threatened, Endangered and Candidate Species** – Grant trained with the leading expert, Robert Stoecker, PhD, in 1994 and 1995 to gain an understanding of the soon to be listed, Preble's meadow jumping mouse, a threatened species; and since that time, he has completed numerous surveys, habitat assessments, and ESA consultations. He has also performed night-time Swift fox surveys at windfarm sites in southern CO and Boreal toad surveys in northern CO. Prior to relocating to CO Grant performed numerous surveys in N.J., including bobcat surveys to assist in protecting the Pyramid Rock Natural Area; Pine Barrens and gray tree frog surveys, and native Pine Barrens fish surveys with his mentor, Dr. Rudy Arndt; and Eastern box turtle surveys. He also assessed migration routes and alternative mitigation measures for sea turtles that were being impacted by the Garden State Parkway.

Wetland Mitigation and Habitat Restoration

- **Park Creek Mitigation Bank, Fort Collins, CO –** ecos was retained by Burns and McDonnell to assess, map, and prepare preliminary mitigation design of aquatic, wetland, riparian and terrestrial habitat in support of a mitigation banking prospectus. Upon completion and acceptance of the prospectus by the USACE, ecos has been tasked to manage the baseline assessment of the site, including groundwater testing, topographic surveys, and hydrology; prepare a detailed habitat design for inclusion in mitigation banking instrument; as well as coordinate design-build process with a selected nursery and contractor.
- **Front Range Mitigation and Habitat Conservation Bank –** ecos is assisting Restoration Systems, LLC (RS), the Bank Sponsor, with the assessment, planning and design of the Front Range Umbrella Bank for Aquatic Resource Mitigation & Habitat Conservation (Bank). This “umbrella” Bank is intended to provide habitat mitigation for projects along the entire Front Range of Colorado. The **ecos**/RS Team is in the process of securing viable sites in the major watersheds along the Front Range; and recently submitted the Draft Prospectus for the establishment of the Bank to the U.S. Army Corps of Engineers, Albuquerque District, Southern Colorado Regulatory Office and Omaha District, Denver Regulatory Office.
- **Lions Park Poudre River CWA and ESA Mitigation Site** - ecos assisted Greeley in developing and constructing an advance river and wetland mitigation site at Lions Park in LaPorte, Colorado that may be used for future CWA impacts in the Poudre River watershed. We also prepared a conceptual design for Preble’s meadow jumping mouse habitat that will be used to support ESA consultation. ecos assessed the site, prepared the designs, and coordinated review with Greeley, Colorado Department of Parks and Wildlife, Larimer County Parks and Open Lands and Larimer County Engineering Department. The mitigation site provides compensatory mitigation for impacts to wetland and waters of the U.S. under the CWA and will also provide compensation for PMJM habitat under the ESA. This mitigation project entails development of mitigation measures including bioengineered streambank stabilization, fishery habitat enhancement, riparian and wetland habitat restoration and PMJM habitat enhancement.
- **Bellvue Transmission Line Project, Preliminary Compensatory Mitigation Plan (PCMP) -** Mr. Gurnée was the Project Manager for the preparation of the Preliminary Compensatory Mitigation Plan (PCMP) for the Bellvue Transmission Line Project. Built upon preferred strategies in the 2008 Corps Compensatory Mitigation Rules, the PCMP leverages a broad strategy to ensure mitigation success and employs a watershed approach to select and prioritize compensatory mitigation (CM) measures that will best mitigate adverse environmental effects. It is intended to support a Corps determination of minimal adverse effect and allow verification of the Northern Segment of the Project under Nationwide Permit 12. Grant led the Team during the watershed assessment of the Poudre River, identification and prioritization of potential CM and preservation sites, development of a Pilot Watershed Plan, and conceptual design of priority CM sites. The PCMP has been submitted to the Corps for review and approval.
- **Flatirons Parcel Riparian and Wetland Habitat Restoration Project** – Grant assisted Greeley in developing a multiple use project at the Flatirons Parcel, a gravel quarry site in Greeley, Colorado. The site is being decommissioned over the next decade and offers great potential to create a system of ponds connected via a naturalized stream that discharges into the Poudre. The concept design incorporates recreation opportunities that are tied into the Poudre River Trail, a passive park, and the development of wetland, riparian and wildlife habitat.
- **Ruby Pipeline Wetland, Riparian and Waterbody Mitigation and Restoration Plan, WY, UT, NV AND OR -** Mr. Gurnée was the lead restoration ecologist and wetland scientist for the 675-mile, Ruby Pipeline; a natural gas pipeline traversing four states. He was the lead for the preparation of Wetland Mitigation,

Riparian and Waterbody Restoration Plans under the CWA, BLM regulations and state equivalent programs. The plans included regulatory guidelines, requirements, and processes; and ecoregion specific restoration plans. The plans detailed specifications for the basis of design, construction, and revegetation; outlined performance criteria, maintenance and monitoring methods for the restoration of approximately 460 acres of temporary wetland impacts.

- **River Point, Sheridan, CO -** Mr. Gurnée was the project manager and lead restoration ecologist for the team that assessed, permitted and designed the natural and aesthetic features of this Brownfields project. The project included a naturalized water quality swale and riverfront improvements which complement the aesthetics and ecology of the South Platte River corridor. The swale was designed to mimic the form and function of a tributary stream, providing passive water treatment with native wetland and riparian vegetation, as well as flood attenuation with instream structures and grade control. The project utilized natural, "bio-engineering" and "bio-technical" techniques to repair and maintain channel and stream bank stability, and native vegetation to enhance and restore habitat. This project also addressed the interface of proposed restaurants, a regional greenway trail, and the river through planning and design of nature trails, interpretive nodes and overlooks/access features that will function to both stabilize banks and help connect people with the river.
- **Caribou Peat Bog Restoration, Nederland, CO –** Grant performed the impact assessment, prepared native plant community design, planting cost estimate, and on-the-ground oversight of restoration volunteers to restore a high-altitude peat bog disturbed by an illegal off-road-vehicle "mudfest".
- **Opportunity Ponds Operational Unit, Anaconda, MT -** Mr. Gurnée was the project manager and lead restoration ecologist providing technical support to Atlantic Richfield/British Petroleum at a Superfund site in the Upper Clark Fork River basin in Montana between 1995 and 2008. Services included wetland delineation and functional assessment of over 3,000 acres of wetland, stream and pond habitat; design of stream and wetland habitat mitigation projects; and permitting/compliance services. The largest project within the Superfund site was the Opportunity Ponds, a 908-acre wetland, stream and wildlife habitat creation project. The project will result in the largest freshwater mitigation project in the U.S; and is intended to mitigate for historic wetland/waters impacts from Anaconda Mining Company operations and current impacts resulting from remedial actions associated with the Superfund cleanup process.
- **The Club at Flying Horse Golf Course, Colorado Springs, CO –** On behalf of Classic Communities, Grant and his Team assessed wetland habitat, recommended impact avoidance and minimization measures, and prepared the Section 404, CWA permit for a 1500-acre mixed use development and Weiskopf golf course. The project aesthetic and mitigation measures included the design of native prairie roughs, meandering stream channels and native wetland meadows within the golf course. Extra wetland mitigation was created to serve as a private mitigation bank for the client.
- **Maloit Park, Minturn, CO -** Grant was the project manager and restoration ecologist for the Maloit Park Restoration Project, which was necessitated by the accidental release of mine slurry that contaminated the soils and vegetation of critical wetland habitat at the confluence of Cross Creek and the Eagle River. The project included the assessment of the site, the collection of native wetland seed (that was adapted to site conditions); the selection of appropriate replacement soil; the design of the restoration grading and planting plans; and oversight during the soil replacement, grading and planting phases. Mr. Gurnée also provided follow-up monitoring and reporting to ensure the successful establishment of the wetland habitat.
- **Department of Energy, Private Mitigation Bank, Westminster, CO -** Mr. Gurnée provided the project assessment, design, permitting, mitigation banking instrument negotiation with the Corps and EPA, and construction supervision of a 12-acre wetland mitigation bank for the Department of Energy in Westminster, CO. The project provides compensatory mitigation for impacts associated with the Rocky Flats clean-up and remediation project. It should be noted that this was the first private mitigation bank negotiated in Colorado, and as such it assisted in setting the precedent for future negotiations.
- **Saudi Arabia Coastal Wetland Restoration -** Mr. Gurnée assisted in the restoration planning for 67 square kilometers (41 square miles) of high salt marsh (sabhka) impacted by Gulf War oil spills.

Aquatic, Wetland, and Riparian Habitat Design

- **Big Thompson River Flood Recovery and Restoration, Loveland, CO -** ecos is currently part of a multi-disciplinary team assisting the Big Thompson Watershed Coalition (BTWC) with assessment, design, and construction of the Big Thompson between Rossum and Wilson Drives which are majority-owned by the City of Loveland and Loveland Ready-mix. As with all the flood recovery projects ecos has worked on, we

produced 30%, 60% and 100% design plans, construction cost estimates, and specifications guiding soil development/enrichment; upland, riparian, and wetland seeding and planting; and numerous bioengineering techniques aimed at restoring the river and making it more resilient to future flood events. This project is aimed at completion in the summer of 2019.

- **Saint Vrain Creek Reach 3 Flood Recovery and Restoration, Boulder County, CO** - ecos is part of the Design Team assisting Boulder County Parks & Open Space (BCPOS) with the restoration, repair and enhancement of the reach of the Saint Vrain Creek from Highway 36 downstream to Hygiene Road in rural Boulder County, which was damaged by the 2013 floods. Our role on the project includes: 1) desktop and field assessment to inventory and document the characteristics of the stream reach and riparian corridor (e.g. stream/in-stream features, vegetation, wildlife habitat); identify and locate significant habitat features within the areas of proposed construction; identify potential sources of native plant materials for restoration; and identify areas of opportunity within the breach repair work areas for native vegetation, wetland, PMJM, leopard frog and fishery habitat restoration; and delineate wetland habitat and waters of the U.S. in all areas of proposed/potential construction-related impact; 2) vegetation community and wildlife habitat restoration design and fish passage design parameters; 3) permitting and compliance under the CWA, ESA and NHPA; 4) construction oversight for restoration construction; and 5) monitoring and reporting project success/establishment to BCPOS, stakeholders, the Corps, FWS and the State of Colorado Department of Local Affairs (DOLA) under the (the Grant funding agency under the Community Development Block Grant Disaster Recovery (CDBGDR) Resilience Planning Program grant.
- **Bohn Park Flood Recovery Design, Town of Lyons, CO** – ecos is part of the Design Team assisting the Town with the restoration, repair and enhancement of Bohn Park in Lyons, which was damaged by the 2013 floods. Ecos roles is to assess and design the natural restoration of the vegetation communities and habitat along St. Vrain Creek and riparian corridor; and to support the project design by acquiring permits/approvals and maintaining regulatory compliance under the CWA, ESA and National Historic Preservation Act (NHPA). The final design will address goals and priorities associated with the Parks Flood Recovery Planning Process, FEMA Project Worksheets and Project Scopes, the Lyons Recovery Action Plan (LRAP), associated Program Development Guides (PDG's), existing Town master plans, comprehensive plans and other relevant documentation and studies.
- **James Creek Post-Flood Restoration, Lefthand Watershed Oversight Group (LWOG), Jamestown, CO** – ecos was part of the LWOG and Boulder County Department of Transportation Team responsible for preparing the 30-60% design package for James Creek Reach 16 as identified in the Left Hand Creek Watershed Master Plan. ecos performed pre- and post-flood plant community assessment; developed revegetation goals and objectives, the basis of design, monitoring protocols, and revegetation plans in accordance with Colorado Department of Local Affairs (DOLA), Community Development Block Grant – Disaster Recovery (CDBG-DR) 30% Guidelines. Specific resources and issues of concern addressed by ecos, included federal and state listed candidate, threatened and endangered species, wildlife species of concern (including raptors), fisheries and fish passage, native plant communities, and management of noxious weeds, all in concert with geomorphic, hydrology and hydraulic analysis and design prepared by other team members.
- **Saint Vrain Creek Restoration and Floodplain Resiliency Plan, Lyons, CO** – ecos is part of the design-build team intent on restoring the St. Vrain Creek corridor in the Town of Lyons that was damaged during the September 2013 flood event. The goal of the project is to create a more resilient floodplain and natural channel condition that will alleviate future threats to the community, reestablish floodplain connectivity, stabilize banks, and restore aquatic, wetland and riparian habitat that was wiped out during the flood. Grant is responsible for CWA, ESA, Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act permitting; as well as developing the plant communities and revegetation strategies needed to restore aquatic and riparian structure and functions within the corridor that support fish, wildlife, recreation, and help the town regain the ecological benefits and economic value they receive from outdoor enthusiasts.
- **Bellvue Raw Water Ponds Riverbank Restoration, Bellvue, CO –** The 2013 flood on the Poudre River altered the course of the river and severely eroded a bank nearly causing a breach of the City of Greeley's raw water ponds – their main municipal water supply. The goal of the project was to stabilize the bank to protect the ponds and to create riparian habitat for the Preble's meadow jumping mouse, a federally listed threatened and endangered species. Jon was responsible for preparing bioengineering design plans and specifications that include soil/cobble encapsulated lifts, stream barbs to deflect flows away from the bank, and harder, biotechnical design of soil/riprap and stream bed scour protection measures to prevent erosion

and further undermining and sloughing of the bank. Design plans included specification of native plant materials and various techniques to restore cottonwood forest and willow habitat to further stabilize the bank.

- **Poudre River Pipeline Crossing at Kodak, Windsor, CO –** ecos role on the project was to assess restoration potential, techniques, and prepare design plans and performance specifications to reclaim a pipeline corridor across the lower Poudre River where the City of Greely had to replace 3 major water supply lines. ecos also provided oversight during the construction of site and riverbank stabilization and restoration measures following installation of the pipelines.
- **Lions Park Poudre River Restoration Plan, Laporte, CO –** ecos role on the project was to assess habitat conditions; gather, compile and analyze field survey data; and to prepare the mapping and mitigation design plans for the Lions Park PMJM habitat and the Poudre River Bank Stabilization Plans. We designed and executed the technical drawings for the structural components of the habitat, ensuring that the proposed riparian plant community, habitat structures (brush piles), and bioengineered streambank stabilization measures will create the conditions that alleviate the current habitat fragmentation; support the life requisites of the PMJM; and enhance the overall health of the Poudre River fishery.
- **C Lazy U Ranch, Willow Creek Fishery Enhancement Plan, Granby, CO -** Mr. Gurnée was the lead fisheries biologist and wetland ecologist for the assessment and design of this project. The project entailed 2 miles of instream and riparian cover habitat aimed at enhancing water quality through increased bank stability, improving aquatic habitat and angling opportunities, and providing long-term stability to the reach given existing land-use constraints, and ongoing ranching activities. Bank-side improvements included wetland mitigation design to support ranch impacts, detailed seeding and planting plans indicating site-specific plant and seed locations, life zones, and species palettes according to hydrologic, soil, and aspect conditions. Grant was the regulatory lead, consulting with the Corps under Section 404 of the CWA.
- **Edwards Eagle River Restoration Project, Edwards, CO –** Grant was the senior wetland ecologist and fisheries biologist for the Edwards Eagle River Restoration Project (Project); which is roughly 1.5 miles long covering an area of 168 acres of floodplain along the Eagle River in the heart of the Edwards community. The project utilized indigenous materials and methods to naturally integrate habitat structure in the landscape context. He provided grant funding support; stream, riparian, wetland and fisheries habitat assessment, planning and design; and construction oversight services to the Eagle River Watershed Council for the Project. He assisted the ERWC in facilitating the public process associated with developing stakeholder support and gaining funding through the Eagle Mine Natural Resources Damage Fund. The Project was awarded over $2,000,000 in grant funding; $1,400,000 of which was from the Eagle Mine NRDF. The total project cost is projected at $4,300,000.
- **Gypsum Creek Fisheries Enhancement, Gypsum, CO -** Mr. Gurnée was the lead fisheries biologist and restoration ecologist for the instream and riparian habitat assessment, design, permitting and implementation of habitat improvements along Gypsum Creek. Project treatments included both instream and bankside treatments. Instream treatments served to improve deep-water habitat, create flow separation or concentration zones, increase low flow sinuosity, provide instream cover, improve adult fish habitat, create nursery areas, and enhance spawning opportunities. Bankside treatments for aquatic habitat improvements included creation or enhancement of overhead cover; provision of protective cover; and enhancing shading, cooling, and nutrient cycling functions. Bank protection treatments served to correct localized bank instabilities and reduce bank erosion and the potential for sediment deposition downstream. The Colorado Division of Wildlife (CDOW) commented that, “The Gypsum Creek project was implemented in such a low impact manner that you cannot tell that construction had occurred in the area.”
- **Cache La Poudre River Removal Action, Fort Collins, CO -** On behalf of the City of Fort Collins, Mr. Gurnée led negotiations between the EPA, stakeholders and the City regarding riverine, riparian and wetland regulatory and restoration design standards during the removal and remediation of a contaminated reach of the Poudre River. He also provided design review and revision, as well as construction oversight to ensure successful implementation of the instream and streambank restoration along the 0.50 mile, highly visible reach of the river near downtown Fort Collins.
- **TZ Ranch, Elk Hollow Creek Fishery Habitat Enhancement Plan, Saratoga, WY -** ecos performed the assessment and design of the Elk Hollow Creek Project, which included instream and riparian habitat improvements aimed at increasing bank stability, improving aquatic habitat and angling opportunities, and providing long-term stability to the reach. Instream improvements included drop structures, plunge pools, deep pools, riffles and spawning habitat. Bank improvements included seeding and planting plans for

native wetland and riparian species. Grant was the regulatory lead, consulting with the Corps under Section 404 of the CWA and the Wyoming Department of Fish and Game. ecos also provided construction oversight and native plant installation services to ensure the successful implementation of the Project.

- **Brush Creek Fishery Enhancement Plans, Saratoga, WY –** Grant assisted in the preparation of access and staging plans, design plans and details, and performed on-site construction oversight of instream and riparian habitat enhancements and bioengineered bank stabilization for a 3-mile reach of Brush Creek. The purpose of the project is to enhance fish, bird and wildlife habitat and use these resources to facilitate education and improve the recreational experience of Ranch guests.
- **Brush Creek Ranch Pond Creation Plans, Saratoga, WY –** ecos provided design-build services including site optimization selection; excavation, grading, drainage and revegetation plans; and construction oversight for a 0.30-acre fishing pond. The pond design included an innovative undercut bank design incorporating a framework of trees supporting transplanted, native sod; which provided excellent fish habitat.
- **Boulder Creek Fishery Enhancement and Pond Creation Project, Boulder, CO -** Grant was the lead fisheries biologist and restoration ecologist for this project along a private reach of South Boulder Creek adjacent to City of Boulder, Eldorado Canyon Open Space. His tasks included instream and riparian habitat assessment, design of instream and pond fishery habitat and riparian enhancement measures and permitting and consultation. Grant was also the regulatory lead, consulting with the FWS regarding PMJM habitat and with the Corps under Section 404 of the CWA.
- **Stream and Floodplain Restoration at A.T. Massey Coal Mining Facility, KY -** Grant was the Project Manager, fisheries biologist and restoration ecologist for the technical team tasked with assessment and restoration of 26 miles of stream corridor following the accidental release of 250 million gallons of coal slurry into two separate drainages in eastern Kentucky. He was the first ecologist to respond after the spill to ensure that fisheries, stream and riparian habitat restoration objectives were incorporated into the selected cleanup measures. As such, Grant devised a "triage" categorization and remediation system for all affected reaches that minimized impacts to sensitive aquatic and riparian habitat based on the site-specific level of cleanup and remediation required. In addition to instream and bank restoration and stabilization, comprehensive riparian corridor restoration was a major component of the project. Grant was the regulatory and permitting lead and coordinated permits and approval with EPA, Corps and State agencies.
- **Roaring Fork Golf and Fishing Club, Basalt, CO -** Mr. Gurnée was the lead fisheries biologist and restoration ecologist for the assessment, design, permitting and construction supervision of a native trout stream (1 mile) with associated wetland complexes (3 acres). The trout stream was created as an amenity and functional fly-fishing challenge for this fishing component of the Roaring Fork Club; and the associated wetland and riparian habitat were created to naturalize the stream and provide compensatory mitigation for impacts associated with the development of the club facilities. Grant was the regulatory and permitting lead and coordinated permits and approval with Corps and CDOW.
- **Spring Creek Wetland Mitigation, Colorado Springs, CO** – Grant and his team generated wetland and creek creation plans that integrated required mitigation into a high density, "new urban" development. The design emphasized re-utilization of urban storm water to sustain wetlands, use of indigenous plants, construction materials, and natural geomorphic relationships.
- **Tobacco Island Project, Kansas City, MO -** Grant was the lead fisheries biologist and restoration ecologist on a multi-disciplinary Team for the Corps, Tobacco Island Project - a portion of the Missouri River Bank Stabilization and Navigation, Fish and Wildlife Mitigation Project. Project tasks included assessment and conceptual design of measures aimed at reconnecting floodplain and riparian habitat to a reach of the Missouri River near Kansas City. He prepared preliminary designs of channel and backwater wetlands; provided regulatory analysis under Section 404 of the CWA; and assisted in the preparation of an Environmental Impact Statement.
- **San Miguel River Corridor Restoration Plan -** Mr. Gurnée was the lead restoration ecologist, planner and designer for phase 1 of the San Miguel River Corridor Restoration Plan, which included a 1-mile reach through Town. He and his team assisted the Town of Telluride in applying for and winning approximately $500,000 in Natural Resource Damage Assessment Fund money from the State of Colorado. The money, along with other funding, was utilized for final design and construction of the project which included instream habitat, streambank restoration, riparian and wetland restoration, trails and parks. Grant was

responsible for leading all public meetings, regulatory negotiation and permitting; assisted the Town with grant funding; and provided construction oversight services.

- **High Altitude Stream Restoration at Copper Mountain Resort, CO -** Grant was the lead ecologist for the restoration of an alpine stream and enhancement of associated wetland and riparian habitat situated within tundra habitat atop Union Peak at Copper Mountain Resort. Grant performed the assessment, design, permitting, and construction oversight for one of the highest altitude stream restoration and wetland mitigation projects in Colorado (approximately 11,500 feet above sea level). Innovative bioengineering and construction techniques were designed and adapted to this sensitive environment to minimize construction-related impacts and maximize environmental benefits.

Threatened & Endangered Species Consultation & Habitat Restoration

- **Jackson Creek Land Company PMJM and Wetland Mitigation, Colorado Springs, CO –** ecos has been performing PMJM habitat biological assessments, conservation, mitigation planning and design throughout its range since 1994. Among numerous other private land developers in the Colorado Springs areas, ecos is currently assisting the Jackson Creek Land Company and Triview Metropolitan District with the implementation of physical habitat preservation and mitigation measures, including shortgrass prairie, upland hibernaculum, and riparian habitat restoration. We are also assisting the client with construction oversight and maintaining regulatory compliance during the implementation of the phased mitigation plans.
- **The Farm (formerly Allison Valley Ranch), Colorado Springs, CO –** Mr. Gurnée performed the habitat assessment and mapping; and prepared ESA, Section 7 and CWA, Section 404 consultation documents as required by the FWS and Corps, including mitigation construction documents, specifications, on-site layout of plant communities and construction supervision aimed at restoring wetland and riparian habitat occupied by Preble's meadow jumping mouse. Ecos is currently assisting the owner with construction oversight for habitat restoration and native planting.
- **Advance Mitigation for PMJM Habitat** – ecos is assisting a private client in identifying, assessing, prioritizing and designing advance mitigation sites for PMJM habitat in the North Fork and main stem of the Cache la Poudre River.
- **TriView Metropolitan District ESA and CWA Permit Resolution, Monument, CO -** Mr. Gurnée represented the TriView Metropolitan District (TriView) and Phoenix Bell as the lead consultant to resolve outstanding compliance issues related to a joint ESA, Section 7 Consultation and CWA, Section 404 Permit. Grant lead negotiations amongst the various landowners, TriView and the Town to resolve compliance issues related to PMJM and wetland habitat, such that development may proceed in this core area of the town. Upon resolution and agreement of the stakeholders, he led the negotiations with the FWS and Corps to formally amend the Biological Opinion and 404 Permit. Once the approvals were amended, Grant lead the planning and design of PMJM and wetland habitat to meet mitigation requirements under the ESA and CWA.
- **Bernardi Residential Property, Eldorado Canyon, Boulder, CO –** ecos consulted with the Corps and FWS to document and fulfill regulatory requirements for a residential home construction project in PMJM, wetland and riparian habitat. Mr. Gurnée coordinated with the FWS and Corps and obtained approvals under ESA, Section 7 and CWA, Section 404. He prepared all consultation documents, including the Biological Assessment, mitigation plan, and construction documents and specifications. Grant is leading the on-site layout of plant communities and construction supervision, aimed at restoring wetland and riparian habitat occupied by the PMJM.
- **Northgate Boulevard Realignment, Colorado Springs, CO –** Mr. Gurnée performed the habitat assessment and mapping; and coordinated and prepared ESA, Section 7 and CWA, Section 404 consultation documents as required by the FWS and Corps, including mitigation construction documents, specifications, on-site layout of plant communities and construction supervision aimed at restoring wetland and riparian habitat occupied by Preble's meadow jumping mouse.
- **Jefferson County Highways and Transportation Department Gunbarrel Bridge Replacement, Oxyoke, CO -** ecos staff consulted with the Corps, FWS, CDOT, and the FHWA to document regulatory requirements for a bridge replacement project in PMJM, wetland and riparian habitat. He and his Team produced a CDOT Wetland Finding Report, Biological Assessment, acquired a Section 404 Permit and Biological Opinion (Section 7 of the ESA), and then implemented habitat mitigation improvements at the site.

- **Northgate Project, Colorado Springs, CO -** As project manager, Mr. Gurnée led the team in the assessment, permitting and regulatory negotiation (Section 404 of the CWA and Section 7 of the ESA) for the project which included the planning, design and construction supervision of a precedent setting, "joint" mitigation plan for 60 acres of wetland, riparian and PMJM habitat.

Ecological Master Planning

- **Sundance Trail Guest Ranch, Larimer County,** CO – ecos is currently assisting a local guest ranch in the assessment of natural resources and site features, and the development of site plans to balance natural habitat and aesthetic values with the expansion of guest facilities and services.
- **Sand Creek Channel Improvements Stability Analysis at Indigo Ranch, Colorado Springs, CO** - ecos was retained to perform an analysis of channel stability under proposed development conditions for a 1.17-mile reach of Sand Creek. Ecos utilized existing vegetation composition data, density and height within the Project reach as a basis; and compared the 10-year and 100-year storm event modelling data (specifically flow velocity, flow depth and shear stress) to reference literature to provide a professional opinion regarding the future stability of the channel under developed conditions. The analysis of channel stability for the proposed Project assumes a bioengineering and biotechnical approach that preserves and enhances the existing vegetation, as well as substrate cohesion and stability, within the channel and its streambanks. The Stability Analysis will likely serve as a benchmark study for the City of Colorado Springs to use to preserve other naturally stable channels.
- **Uncompahgre River Corridor Master Plan, Montrose, CO –** Grant and his Team assessed the character, condition and quality of aquatic, wetland and riparian habitat along a 10-mile rural and urban corridor of the Uncompahgre River through the City of Montrose. Habitats were then rated, ranked, prioritized and master planned for their preservation potential and integration in to the parks, recreation and trail system. The master plans form the foundation for the City to focus environmental stewardship, tourism and generate riverfront economic development with a focus on the river – the major asset of the Community.
- **Brush Creek Stewardship and Enhancement Plan, Saratoga, WY –** Mr. Gurnée managed the assessment of a 12,000-acre, private ranch near Saratoga, Wyoming and the preparation of the Ranch Stewardship Plan (Plan). The Plan includes land and resource stewardship goals, objectives, and implementation action items; including ranch-wide master planning of the trail and recreational systems, design of the Brush Creek riparian corridor trail, and restoration/fisheries habitat enhancement of Brush Creek. Trail and recreation planning and design focused on universal access, habitat sensitivity, environmental education, and wildlife observation opportunities and unique landscape experiences.

Environmental Assessment and Impact Studies

- **NEPA EA for Eagle County Airport Runway Expansion, Eagle County, CO -** Grant was project manager and senior ecologist for an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA) for a proposed 1000-foot runway expansion and ILS installation at the Eagle County Airport, west of Vail, Colorado. Critical issues addressed included noise, ecological, and public opinion considerations. Grant conducted the work under FAA guidance requirements for EAs.
- **NEPA EA for the Avon Interstate 70 Interchange -** Mr. Gurnée was project manager and senior ecologist for this NEPA EA. He performed environmental assessment and data compilation work for construction of a new CDOT interchange and associated development on Interstate 70. This included evaluating T&E Species; a wetlands inventory; a cultural/archeological resources survey; noise and air pollution modeling and studies; and reviewing soils, meteorology, geologic hazards, and other impacts.
- **Raritan River Wetland Inundation Impact Study, N.J. -** Grant's work on the preparation and processing of the first Individual Permit under the New Jersey Freshwater Wetlands Protection Act of 1987 included a precedent setting wetland inundation study. This study shaped the N.J. Department of Environmental Protection's policy regarding the need to assess hydrologic impacts during wetland permit reviews.

Construction Oversight and Plant Installation

- **St. Vrain Creek Reach 3 Flood Recovery and Restoration, Lyons, CO –** Ecos performed construction lay-out and observation during the implementation of the restoration and enhancement of 0.60-acre of riparian Preble's Meadow Jumping Mouse Habitat (PMJM) along the St. Vrain River.

- **2013 Flood and 2014 Runoff Events, Damage Restoration, Cache la Poudre River, CO** - ecos performed the construction oversight of 3 flood and runoff damage restoration projects along the Cache la Poudre River for the City of Greeley, including the Bellvue Treatment Plant Raw Water Ponds Restoration, the Kodak Pipeline Crossing Restoration and the Watson Lake Pipeline Crossing Restoration.
- **Lions Park CWA and ESA Mitigation Site** - ecos performed the construction oversight for an advance river and wetland mitigation site at Lions Park in LaPorte, Colorado.
- **TZ Ranch, Elk Hollow Creek Fishery Habitat Enhancement Plan, Saratoga, WY -** ecos performed the construction oversight for the Elk Hollow Creek Project.
- **Brush Creek Ranch Fishery Enhancement Plans, Saratoga, WY –** Mr. Gurnée assisted in the construction oversight for a 3-mile reach of Brush Creek to improve fisheries and outdoor recreation experiences for guests of the Ranch.
- **C Lazy U Ranch, Willow Creek Fishery Enhancement Plan, Granby, CO -** Grant assisted in the construction oversight for this fishery habitat, channel stabilization and streambank restoration project.
- **Standley Lake Protection Project, Westminster, CO –** Mr. Gurnée performed construction oversight of a 12-acre created emergent wetland that he and his Team designed to fulfill CWA mitigation requirements and bring closure to the City's drinking water protection project.
- **Caribou Peat Bog Restoration, Nederland, CO –** Grant prepared native plant community design, planting cost estimate, and on-the-ground oversight of volunteers to restore a high-altitude peat bog disturbed by an illegal four-wheel drive "mudfest".
- **Department of Energy Wetland Mitigation Bank, Westminster, CO –** Mr. Gurnée provided construction supervision of the grading and planting of a 12-acre wetland mitigation bank that he and his Team designed for the Department of Energy.
- **ARCO Lower Area One and Butte Reduction Works, Butte, MT –** Grant performed construction observation and supervision of temporary labor crews to plant a passive treatment wetland designed to absorb heavy metals from groundwater.

Natural Treatment System Design

- **Natural Treatment Wetlands, Butte, MT -** Mr. Gurnée and his Team performed the assessment and design of the ARCO Lower Area One and Butte Reduction Works passive treatment wetlands. These natural treatment systems were situated within two units of a reclaimed superfund site to treat heavy metals in surface and groundwater.
- **Natural Treatment Wetlands, Avondale, AZ –** Grant and his Team performed the assessment and design of a constructed wetland system to treat surface water and inject/recharge the municipal well system for the City of Avondale, AZ. This system successfully alleviated a well moratorium necessitated by a contaminated groundwater aquifer.

PUBLICATIONS:

Giordanengo, John H., Randy Mandel, William Spitz, Matthew Bossler, Michael Blazewicz, Steven Yochum, Katie Yagt, William LaBarre, Grant Gurnée, Robert Humphries and Kelly Uhing. 2016. Living Streambanks, A Manual of Bioengineering Treatments for Colorado Streams. Submitted to the State of Colorado, Colorado Water Conservation Board Denver, Colorado. Submitted by AloTerra Restoration Services, LLC, and Golder Associates, Inc.

Gurnée, Grant E. 1998. Wetland Revegetation Techniques chapter in Native Plant Revegetation Guide for Colorado, Caring for the Land Series, Volume III. A joint publication of the Colorado Natural Areas Program, Colorado State Parks, and Colorado Department of Natural Resources. Denver, Colorado.

Gurnée, Grant E. 1995. Optimizing Water Reclamation, Remediation and Reuse with Constructed Wetlands. Environmental Concern Wetland Journal, Summer 1995 Issue. Environmental Concern, Inc. St. Michaels, Maryland.

PRESENTATIONS & INSTRUCTION:

Gurnée, Grant E., 2016. Clean Water Act, Section 404 Permits for Flood Recovery Projects. Presented at the Colorado Stream Restoration Network (CSRN) conference in Longmont, CO on March 23, 2016.

Gurnée, Grant E., 2016. Endangered Species Act Consultation for Flood Recovery Projects. Presented at the Colorado Stream Restoration Network (CSRN) conference in Longmont, CO on March 23, 2016

Gurnée, Grant E., 2010. Stream Corridor/Bioengineering Round Table. Presented at the Colorado Riparian Association (CRA) Sustaining Colorado Watersheds Conference. October 5 - 7, 2010. Vail, Colorado.

Gurnée, Grant E. and Greg A. Fentchel, 2009. Stream Corridor/Bioengineering Workshop. Presented at the Colorado Riparian Association (CRA) Sustaining Colorado Watersheds Conference. October 7 - 9, 2009. Vail, Colorado.

Gurnée, Grant E. and Scott J. Franklin, 2008. Section 404 Individual Permits: Negotiating the Application and Follow-up Process. Presented at the CLE International, Colorado Wetlands Conference. May 8 – 9, 2008. Denver, Colorado.

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Gurnée, Grant E. 1999. Wetland Mitigation: Considering Mitigation Requirements in the Project Planning Process. Presented at the Continuing Legal Education (CLE) Wetlands & Mitigation Banking Conference. October 21 & 22, 1999. Denver, Colorado.

Hoag, Chris, Hollis Allen, Craig Fischenich and Grant Gurnée. Assistant instructor for a Bioengineering Workshop sponsored by the U.S. Army Corps of Engineers Waterways Experiment Station and the U.S. Department of Agriculture – Aberdeen Plant Materials Center. September 1998. Carson City, Nevada.

Hoag, Chris and Grant Gurnée. 1998 Glancy Riparian Demonstration Project. Assistant instructor for a hands-on bioengineering workshop on the Carson River. September 1998 near Dayton, Nevada.

Gurnée, Grant E. 1998. Stream and Wetland Restoration Successes and Failures: The Good, the Bad, and the Ugly. Presented at the Colorado Riparian Association (CRA) Restoring the Greenline Conference. October 16, 1998. Salida, Colorado.

Gurnée, Grant E. 1998. Save Our Streams, Wetland Conservation and Sustainability Workshop. Lead Instructor of wetland assessment and restoration course presented with the Izaak Walton League. April 21 & 22, 1998. Boulder, Colorado.

Windell, Jay, and Grant Gurnée. 1998. Creation of a Stream, Riparian and Wetland Ecosystem: Tributary to the Roaring Fork River, Basalt, Colorado. Presented at the American Society of Civil Engineers, Wetlands Engineering & River Restoration Conference. March 23 – 27, 1998. Denver, Colorado.

Gurnée, Grant E. 1998. A Case Study: Department of Energy's Wetland Mitigation Bank at Standley Lake. Presented at the Continuing Legal Education (CLE) International, Colorado Wetlands Conference. January 27 – 29, 1998. Denver, Colorado.

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Gurnée, Grant E. and Gary Bentrup. 1996. Wetland and Riparian Protection Strategies. Presented at the Sierra Club, Regional Growth Strategies Conference, "New Perspectives and Strategies to Preserve Mountain Communities." February 16 – 17, 1996. Glenwood Springs, Colorado.

Gurnée, Grant E. 1994. How to Recognize and Deal with Wetland Regulation Issues. Presented at the Continuing Legal Education (CLE) International, 3rd Annual Western Agricultural and Rural Law Roundup. June 23-25, 1994. Fort Collins, Colorado.

AWARDS:

- Colorado Landscape Contractors Award, Sand Creek Enhancement Project – 2000

PROFESSIONAL ASSOCIATIONS:

- Association of State Wetland Managers (ASWM)

- Society of Wetland Scientists (SWS)
- Environmental Concern (EC)