Kenosha County, Wisconsin

SPECIFICATIONS
FOR

Brighton Dale Links
Red Pine Bunker, Range and Short-Game Renovations

Invitation to Bid #2326

GOLF COURSE CONSTRUCTION

TECHNICAL SPECIFICATIONS

Definitions

Whenever these words are used in the following Golf Course Specifications, they shall have the meaning here given:

Owner: Shall mean the County of Kenosha and its legal representatives.

Golf Course Architect: Quitno Golf Designs, Inc. and its legal representatives

Contractor or Bidder: Shall mean the party entering into this contract for the performance of the work required by it, and the legal representative of said party of the agent appointed to act for said party in the performance of the work.

List of Plans

Along with these technical specifications, the following list of plans shall also be included as part of the bidding documents:

- Title Sheet
- R1 - Demolition Plan
- R2 - Grading and Drainage Plan
- R3 - Restoration Plan
- R4 - Construction Detail

***Note: If any discrepancies are found between the County front-end language and these Golf Course Specifications, then the County language shall prevail.**

DIVISION ONE

SECTION 01010
SUMMARY OF WORK

The Contractor shall provide all labor, materials, and equipment necessary to complete all work as set forth by the drawings and specifications.

1.01 DESCRIPTION

A. Summary of Work. Perform all work as shown and specified. The work is as follows, either wholly or in part.

1. Site Preparation
2. Grading and Earthwork
3. Drainage
4. Feature Construction
5. Site Restoration

1.02 QUALITY ASSURANCE

A. Requirements. The Contractor shall be solely responsible to ensure that all work is in compliance with all applicable local, state, and federal requirements regarding materials, methods of work, public safety, and disposal of excess and waste materials.

B. Inspections, Permits, and Fees. The Contractor shall investigate and obtain necessary local permits and/or licenses to perform work within the local municipal, county and/or state district(s). The Owner shall assist, where possible, to obtain a waiver of any fees for permits which might be assessed.

C. Materials and Methods. The Contractor shall be responsible to ensure that materials and methods of construction shall comply with the following standards where applicable.

1. American Society for Testing and Materials (ASTM)
2. American Association of State Highway and Transportation Officials (AASHTO)
3. National Fire Protection Association (NFPA)
4. American Concrete Pipe Association (ACPA)
5. National Electrical Code (NEC)
6. National Sanitation Foundation (NSF)
7. The Irrigation Association (IA)
8. American Sod Producers Association (ASPA)
10. American Standard for Nursery Stock (ASNC)
11. Asphalt Institute (AI)
12. National Crushed Stone Association (NCSA)
13. American Concrete Institute (ACI)

D. Installation of Manufactured Articles. Installation of all manufactured articles shall be in accordance with the recommendations of the manufacturer. Where necessary to the proper operation of the manufactured items, and in all cases where required by the specifications, the manufacturers will furnish a factory trained service engineer to supervise the installation and start the operation of the article. Where factory supervision is a requirement for the furnishing of the required warranties, it will be provided whether stated in the specifications or not.

1.03 SITE EXAMINATION

A. Examination of Site. Bidders shall, with representative of Owner, visit site of proposed work and fully acquaint themselves with conditions as they exist, so that they may fully understand the facilities, difficulties, and restrictions attending the execution under the contract. Bidders shall also thoroughly examine and be familiar with the contract documents. The failure or omission of any bidder to receive or examine any form, instrument, or to visit the site (s) and acquaint himself with conditions there existing shall in no way relieve any bidder from any obligation with respect to his bid. By submitting a bid, the bidder agrees and warrants that they have examined the site(s) and contract documents, and where the contract documents require in any part of the work a given result to be produced, that the specifications and drawings are adequate and the required result can be produced under the specifications and drawings.

No plea of ignorance of conditions that exist or of conditions or difficulties that may be encountered in the execution of the work under this contract, as a result of failure to make the necessary investigations, will be accepted as an excuse for any failure or omission on the part of said contractor to fulfill in every detail all of the requirements of said contract, specifications, and plans, or will be accepted as basis for any claims whatsoever, for extra compensation. Upon application, all available information in the possession of the Golf Course Architect and Owner will be shown to the bidders, but the correctness of any such information is not guaranteed.

1.04 PROJECT CONDITIONS

A. Existing Conditions. Prior to and during the performance of the work, inspect and note surface and subsurface conditions on site and as presented by drawings and specifications. Notify Owner of conflicts or discrepancies prior to commencing or continuing site construction. Examine proposed construction areas and conditions of construction. Do not start or continue construction work until unsatisfactory conditions are corrected.

B. Existing Utilities and Services. Underground and surface utility lines and services are indicated on the drawings, according to best available information. Contractor shall locate and identify existing (public) underground and overhead services and utilities within contract limit work areas. Owner shall locate and identify all private utilities not provided by the public marking service. Provide adequate means of protection for utilities, services, and on-site improvements designated to remain. Perform construction work near utilities and services by hand. Repair utilities, services, and site improvements damaged during construction at Contractor's expense.

1.05 USE OF SITE

A. Protection of Site Facilities. Protect existing building, paving, and other facilities on site and adjacent to site from damage caused by site construction work. Restore to original grade and condition those areas adjacent to site having been disturbed or damaged during site construction. Cost of repair and restoration of disturbed or damaged areas to be at Contractor's expense.

B. Existing Trees and Vegetation. All existing trees and vegetation scheduled to remain, shall be protected against injury or damage resulting from construction in a manner approved by the Owner. This shall include protection from injury or damage caused by cutting, breaking, or skinning of roots, trunks, or branches. Also included is the smothering or compaction of root zones caused by stockpiling construction materials or excavated materials, vehicular traffic, and the contamination of plant material or root zones with harmful materials or chemicals.

1. Repair trees or vegetation damaged by construction operations in a manner acceptable to the Owner. Repair trees or vegetation promptly to prevent continued deterioration caused by damages.

2. Replace trees damaged beyond repair by construction operations, as determined by Owner, with trees of similar size and species, unless a substitute species is approved by Owner (Director of Golf).

3. Repair and replacement of trees damaged by construction operations due to lack of adequate protection during construction operations shall be at Contractor's expense.

C. Excavation and Structure Protection. Protect excavations or adjacent structures including utility service lines by shoring, bracing, sheeting, underpinning, or other methods, as required to prevent cave-ins or loose dirt from entering excavation. Barricade open excavations and post warning lights at work being performed adjacent to public streets or walks.

D. Protection of Work. Protect all work, whether in progress or complete from adjacent work, pedestrians, or vehicular traffic. Provide temporary barricades and warning lights as required from protection of project work and public safety.

1.06 SITE ACCESS

A. Occupancy of Premises. The Owner shall retain the right to occupy the premises and adjacent facilities during the entire period of construction. Construction operations shall permit Owner's use of the premises and performance of normal operations where feasible.

B. Project Scheduling. When portions of the work are to be performed by separate prime contractors, the Owner shall provide project coordination and scheduling at a pre-construction meeting with representatives from each party.

C. Separate Contractors. When required by concurrent scheduling of construction by separate contractors, the site shall be equally accessible to all parties. Access shall not be restricted by any contractor except as deemed necessary due to scope of work and agreed upon by the Owner.

D. Access Roads. Construction and use of access roads must be approved by the Owner. The Contractor will be liable for any damage to property other than the designated access roads and working areas. The designated access roads will be the responsibility of the Contractor in that they will repair the damage caused by trucks, tractors, etc. and by storage of materials.

E. Work Area. The Contractor shall confine their apparatus, storage of materials, and operations of their workmen to limits as required by the Owner, and shall not unreasonably encumber the premises with their material.

F. Daily Cleanup. Prior to the completion of each work day, or as otherwise requested by the Owner preceding outings or large events, paved parking and entry areas (utilized by the Contractor) shall be swept of all dirt and debris and visible storage areas shall be organized and cleared of trash.

End of Section

SECTION 01300
SUBMITTALS

The Contractor shall provide all labor, materials, and equipment necessary to provide submittals to Owner or as set forth by the drawings, specifications, and contract documents. The costs, fees, or expenses necessary for submittals or testing, as required by the contract documents shall be the responsibility of the Contractor.

1.01 PROJECT ADMINISTRATION

A. Progress Schedule. The Contractor shall submit to the Owner a construction schedule for the work **included with bid submittal**. This schedule shall be in bar graph form based upon project tasks as presented in the bidders documents. Schedule shall be updated weekly and submitted to Director of Golf or appointed designee.

B. Application For Payment. See the Owner-provided bidding and contract documents for all information regarding payment applications.

1.02 PRODUCTS

A. Aggregates. All component materials required by the construction documents for the construction of greens, tees, and bunkers have been pre-determined by the Owner and Golf Course Architect and are listed in Section 01600. Contractor shall be required to ascertain current testing results, either as provided by the material supplier or by submitting samples to one of the certified testing labs listed below (at Contractor's expense), and shall provide those tests to the Owner for verification that they are current and meet the required analysis parameters, including the following:

1. Green Rootzone: Particle size analysis, moisture content, permeability, penetrometer values, crusting, color, pH, shape

2. Bunker Sand: Particle size analysis, moisture content, permeability, penetrometer values, crusting, color, pH, shape

3. Drainage Gravel: Size distribution, permeability, lateral flow, porosity, angle of repose

4. Bridging: Verify compatibility of drainage gravel and bunker sand and/or green rootzone to meet bridging requirements as set forth by bunker liner specifications (Better Billy Bunker) and/or USGA recommendations for putting green construction, if applicable

5. Certified labs:

Turf and Soil Diagnostics
Attn: Sam Ferro
613 East 1st Street
Linwood, KS 66052
855.769.4231

Tifton Physical Soil Testing Laboratory, Inc.
Attn: Powell Gaines
1412 Murray Avenue
Tifton, GA 31794
229.382.7292

Brookside Laboratories, Inc
Attn: Jackie Backman
200 White Mountain Drive
New Bremen, OH 45860

B. Concrete for Synthetic Tee in Range. Provide three (3) concrete cylinder test specimens per each day concrete is poured. Test specimens shall be made and cured in accordance with Standard Method of making and curing Concrete Compression and Flexure Test Specimens in the field (ASTM C31). Specimens shall be cured under laboratory conditions except that when, in the opinion of the Golf Course Architect or Owner, there is a possibility of the surrounding air temperature falling below 40 degrees F, he may require additional specimens to be cured under job conditions. The standard age of test shall be 28 days, but 7-day test may be used provided that the relations between the 7 and 28-day strengths of the concrete is established by test for the materials and proportions used. If 7-day test are used on this project: Hold second cylinder in reserve and test at 28 days if any question of ultimate strength may be present.

C. Seed Vendor's Certification. Submit seed vendor's certification for required grass seed mixtures, indicating percentage by weight and percentage of purity, germination, and weed seed for each seed specified.

D. Sod Grower Certification. Submit sod grower's certification of grass species. Identify source location.

E. Fertilizer Certification. Submit a certification of fertilizer(s) analysis.

1.03 DRAWINGS OF RECORD

A. Layout. Provide layout diagrams of all new tees, greens, bunkers, fairways and cart paths, collected using a GPS system or equivalent, and submitted to Director of Golf in both pdf and Autocad (v2018 or older) format.

B. Drainage. Submit drainage system record drawings of all drainage components installed in greens, bunkers and fairways, collected using a GPS system or equivalent, and submitted in both pdf and Autocad (v2018 or older) format. Document field changes of dimension and detail; document changes made by change order. Document any existing draintile or structures which were encountered, altered or tied into during drainage installation.

C. Irrigation. Provide irrigation as-built information per Irrigation Specifications.

End of Section

SECTION 01400
QUALITY CONTROL

The Contractor shall provide all labor, materials and equipment necessary to complete all quality control requirements as set forth by the drawings, specifications, and contract documents. All work shall be subject to observation and final approval by the Golf Course Architect and owner.

1.01 PERFORMANCE OF WORK

A. Experienced Workmen. All work performed under this contract shall be completed by experienced workmen familiar with all procedures necessary to complete the work as specified by the contract documents. All work shall be performed under the supervision of a qualified supervisor.

B. Products. Comply with all submittals as specified in Section 01300.

1.02 EXECUTION, TESTING, AND OBSERVATION

A. Layout. All work limits, haul roads and staging areas shall be subject to review by the Golf Course Architect. Document any adjustments in the work limits or scope as requested by the Owner and/or Golf Course Architect. Verify impacts on the project quantities and/or budget, if any, and review with Owner and/or Golf Course Architect prior to incorporating changes.

B. Earthwork. All grades and materials furnished for rough grading operations shall be subject to observation by the Golf Course Architect. After establishment of proper elevations, the Contractor shall furnish all assistance necessary to verify grades. No placement of topsoil, sand, or pea gravel will be permitted until after subgrades are observed and approved.

C. Drainage. Prior to tie-in, test all existing drainage basins and pipes being used as outlets for new drainage to ensure their functionality. Any non-functioning outlets must be reported to Owner. Prior to final backfilling and grading, test all drainage work to ensure a free flowing sub-drainage system. Remove obstructions, replace damaged components, and retest system as required. All work shall be subject to random observation by the Golf Course Architect. The Contractor shall furnish all assistance necessary to observe work.

D. Soil Preparation and Grassing. All finish grades, feature tie-ins and grassing preparations shall be subject to review by the Golf Course Architect. No seed or sod placement shall be permitted until final grassing lines have been determined and/or approved by the Golf Course Architect.

E. Concrete. Refer to Submittals Section 01300 for quality control requirements.

End of Section

SECTION 01600
MATERIAL SPECIFICATIONS

The Contractor shall provide all labor, materials, and equipment necessary to submit, furnish, and install materials as required by the drawings, specifications, and contract documents.

1.01 DELIVERY AND STORAGE OF MATERIALS

A. Deliver, store, and handle all materials on site to prevent damage and deterioration.

1.02 EROSION CONTROL PRODUCTS

A. Silt Fencing, shall consist of 2"x2" fir or pine wood posts, 48" tall, and spaced 6' (max) on center. Attached filter fabric shall be 36" wide with the bottom buried 6" (vertically) below finished grade.

B. Straw Wattles, if applicable, shall be weed free, biodegradable straw stuffed in polymeric netting, made in 8" (or 9") X 25-ft lengths and staked at minimum 5' intervals.

1.03 EARTHWORK PRODUCTS

A. Subgrade Fill Material used under green, tee, fairway and bunker features shall be inert subsoil (preferably in situ) and free of sod, brush, roots, stones larger than four (4) inches in diameter, trash, and other perishables or debris from construction operations. If allowed by local regulations, these construction debris items may be placed in bury pits in out of play areas as approved and directed by the Owner.

B. Backfill Material for Trenches (Solid Pipe), unless otherwise specified by drawings, shall be inert, in situ soil, free of clods or stones larger than 1" in diameter and containing no sod, brush, roots, trash or other perishable materials.

C. Topsoil Material, whether in situ or imported, shall consist of a sandy loam silt, or loam with sufficient amounts of organic material to start and maintain plant growth as determined by the Golf Course Architect and/or Owner. Topsoil material shall be free of excess quantities of clay, hard lumps, roots, grass, stones, and other foreign materials.

D. Rootzone Mixture for Greens shall be 7:2:1 mix as provided by Waupaca Sand and Solutions, Contact Chris Cameron 630.336.7626.

E. Sand for Bunkers shall be Fredonia Bunker Sand as provided and delivered by Waupaca Sand and Solutions, Contact Chris Cameron 630.336.7626.

F. Bunker Liner shall be Better Billy Bunker (BBB), which shall be **installed by a BBB certified contractor** at the depths and per the procedures provided by the manufacturer. Contact Todd Jenkins 615.812.2874 for a list of qualified installers.

G. Backfill Material for Perforated Fairway Drainage (2") shall be a Mason Sand with a percolation rate between 6" and 10" per hour.

H. Backfill Material for Perforated Green Drainage (2") shall be consistent with the specified greens construction mix and/or properties of the upper sand layer of the existing green profile. Install in lifts and properly compact to ensure no trench settling.

I. Drainage Gravel for Perforated Pipe (4") and Better Billy Bunker Liner shall be clean, washed, crushed stone or pea gravel, 3/8" to 1/2" in size. Composition of this material shall be compatible with the specified bunker sand and/or greens rootzone mixture as it relates to USGA recommendations for bridging purposes.

1.04 DRAINAGE SYSTEM

A. Drainage Piping (4" and above, perforated and solid) shall be corrugated, double-wall polyethylene pipe and fittings similar or equal to N-12 pipe manufactured and distributed by Advanced Drainage Systems, Inc. (ADS), Columbus, Ohio. Sizes as specified on drawings.

B. Slit Drainage Piping (2", perforated) shall be corrugated, single-wall polyethylene knife-slot drain tile pipe and fittings similar or equal to that provided by 2inchpipe.com

C. Manholes, Catch Basins, and Inspections Risers shall conform to details as shown on plans, or as otherwise approved by Owner and/or Golf Course Architect.

1.05 SOIL AMENDMENTS AND FERTILIZER

A. Fertilizer. Fertilizer shall be uniform in composition, free flowing, and suitable for application with approved equipment. Deliver fertilizer materials in original, unopened and undamaged containers showing weight, analysis, and name of manufacturer. Store in manner to prevent wetting and deterioration. Fertilizer which has been exposed to high humidity and moisture, or has become caked or otherwise damaged making it unsuitable for use, will not be accepted. All amendments above shall be worked into sand/soil after being applied and watered in to settle prior to grassing.

Greens, Tees, Fairways & Roughs	
19-25-5 starter	175 lbs. per acre
21-0-20 / 100% Poly-S	150 lbs. per acre

1.06 GRASSING AND RESTORATION

A. Sod shall be dense, well rooted, grown in mineral soil in the general locality where it is to be used and maintained at a height similar to the associated application (e.g. green, tee, fairway or rough heights). Sod shall be free of debris, weeds and other undesirable contaminants. Provide sod in rolls or panels convenient for handling with personnel or equipment available. Big roll sod will be acceptable, but must be approved by the Owner. Cut, deliver, and install all sod within a 24-hour period. Do not harvest or transport sod when moisture contact may adversely affect sod survival. Protect sod from sun, wind, and dehydration prior to installation. Do not tear, stretch, or drop sod during handling and installation.

1. Sod type for Fairways and Roughs: **HGT Bluegrass**
2. Sod type for Tees: **007xl or approved equal**

B. Seed shall be labeled in accordance with the U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act in effect on the date of invitation for bids. Deliver seed material in original unopened containers, showing weight, analysis, and name of manufacturer. Store in a manner to prevent wetting and deterioration. Seed which has become wet, moldy, or otherwise damaged in transit or in storage will not be accepted. All seed must be Certified Blue Tag sod quality and Oregon or Washington grown. The test date shown on the label must not exceed six (6) months prior to the seeding dates.

1. Seed type for Greens: **007xl at 2 lbs per 1,000 sf**
2. Seed type for Fairways and Roughs: **HGT Bluegrass at 2.0 lbs per 1,000 sf**

C. Hydraulic Mulch shall be applied immediately following seeding per the manufacturer's installation instructions and recommendations. Deliver and store materials in a manner to protect from damage, weather, extreme temperatures and construction operations. Refer to plans for locations of various product usage:

1. Fairways and roughs: Flexterra HP-FGM by Profile Products at 3,000 lbs./acre, or approved equal

D. Bunker Liner shall be installed at the depths and/or per the procedures provided by the manufacturer.

1. Base bid: Better Billy Bunker liner. Contact Todd Jenkins 615.812.2874.

1.07 GRAVEL PAVING AND CONCRETE PAD

A. Cart/Maintenance Path Design Plans prepared by the Golf Course Architect may include shaping, features and/or alignment related to paths. The Owner agrees, at its discretion, to provide a qualified Engineer or other professional to prepare any required final documents covering the design, circulation and/or construction of any new or revised golf cart and maintenance paths consistent with the Owner's selection of the type of golf cart and equipment to be used at this Project. The Golf Course Architect will consult on matters pertaining to golf paths, but shall not be held liable for claims arising from the design or specification of golf paths, nor for any associated claims arising from the operation of golf carts or maintenance equipment, or for rules or regulations covering their use at this Project.

B. Base Material shall be IDOT Aggregate Base Course, Type B, all crushed gravel or crushed limestone, CA6, or approved equal. Install to the thickness indicated (after compaction).

C. Concrete Surface Course for Range Tee Pad shall conform to IDOT Class SI concrete and be formed in place. Curing compound shall be approved and applied as per manufacturer's instructions. Concrete shall be minimum 3,500 PSI concrete mixed and delivered in accordance with the requirements set forth in Tentative Specifications for Ready-Mixed Concrete (ASTM C94). Add fibermesh reinforcement at 1 lb. per yard.

End of Section

SECTION 01700
PROJECT CLOSE OUT

The Contractor shall provide all labor, materials, and equipment necessary to complete all project close out requirements as set forth by the drawings and specifications.

1.01 WARRANTIES

A. Guarantees. Except as otherwise specified in the contract documents, the Contractor shall guarantee workmanship and materials associated with the fulfillment of this contract for a period of one (1) year from date of final acceptance from the Owner. The work shall be left in perfect order at completion and acceptance. Neither the final payment nor termination of the guarantee period, nor any provision in the contract document shall relieve the Contractor of the responsibility for negligence, faulty materials, or workmanship within the extent and period provided by law, and upon written notice they shall remedy any defects due thereto, and shall pay all expenses for damage to other work resulting therefrom. If specifications provide for methods of construction, installation, materials, etc. for which the Contractor cannot guarantee for the indicated period, it shall be the responsibility of the Contractor to inform the Owner in writing before submitting their bid. Otherwise, the Contractor shall be responsible to provide the method of construction, installation, materials, etc., which will be guaranteed for the indicated period of time.

1. Earthwork. All in place earthwork shall be free from heaving or settling due to use of unsatisfactory material, methods of construction, or inadequate compaction. Where earthwork repairs are deemed necessary, the Contractor shall remove the sod, fill and/or regrade, and relay the salvaged sod. Where sod is not salvageable, new sod shall be installed at the Contractor's expense. This no settlement clause shall extend over the entire period of the Contractor's guarantee of the job.

2. Drainage. All in place drainage shall be free flowing and void of interruption from heaving, breaking or settling due to use of unsatisfactory material, methods of construction, or inadequate outlet. Where drainage repairs are deemed necessary, the Contractor shall remove the sod, install new drainage, replace and compact the backfill, and relay the salvaged sod. Where sod is not salvageable, new sod shall be installed at the Contractor's expense. This free flowing drainage clause shall extend over the entire period of the Contractor's guarantee of the job.

3. Grassing. All in place grassing operations shall guarantee the quality and viability of the materials per Section 01600, Material Specifications, and the workmanship as specified in Section 02485, Grassing Specifications, but shall not include grow-in or extended maintenance. This guarantee shall extend until each grassed area has been accepted by the Owner in writing, at which time ownership shall pass from Contractor to Owner. See Maintenance (1.02) for requirements prior to acceptance.

1.02 MAINTENANCE AND FINAL REVIEW

A. Maintain all completed work, installed materials, and other portions of the contract until completion and Owner's acceptance, in writing, of each stage of construction. This includes maintenance and re-establishment against the effects of erosion, wind, vandalism or acts of God.

B. Field review to determine acceptance of completed construction shall be made by the Golf Course Architect and Owner and be subject to compliance with the contract documents.

1.03 PROJECT CLEAN-UP

A. Clean-up. Perform project cleaning during construction and upon completion of construction. Remove from site all excess material, trash, debris, and equipment, repair any damage resulting from construction operations, and complete all clean-up operations prior to final acceptance by the Golf Course Architect and Owner.

B. Waste Material Disposal. Stockpile, haul from site, and legally dispose of waste materials; including excess excavated materials, rock, trash, and debris. If permitted by Owner, waste materials may be transported to a designated disposal area on-site.

2 Disposal Routes. Maintain disposal routes clear, clean, and free of debris.

3 Burning of Material. On-site burning is not permitted, dispose of material off-site or in Owner designated areas.

End of Section

DIVISION TWO

SECTION 02100
SITE PREPARATION

The Contractor shall provide all labor, materials, and equipment necessary to complete all Site Preparation as set forth by the drawings and specifications.

1.01 GENERAL

A. Site Preparation Work. Perform site preparation work as shown and specified. The work includes:

1. Protection of existing underground and overhead services and utilities.
2. Protection of existing trees to remain.
3. Installation of erosion control measures.
4. Stripping turf areas and removing existing sand.
5. Stripping and stockpiling topsoil.
6. Removing designated site improvements.
7. Removing designated vegetation.

A. Quality Assurance. Comply with Specifications Section 01010 and 01400.

B. Materials and Equipment. Comply with Specifications Section 01600.

1.02 CLEARING

A. Trees or Improvements to Remain. Locate and identify trees and site improvements indicated to remain by drawings or specifications. Refer to 01010 Summary of Work, Section 1.05 for information on tree protection.

B. Clearing and Stump Removal (**by Contractor**). Clear and grub all trees and brush indicated on the plans for removal, including excavation or grinding of all stumps to minimum 18" depth. Remove roots (extending beyond stump excavations) as needed to properly grade and prepare soil for restoration. Dispose of all debris resulting from clearing and grubbing off-site in accordance with local municipal laws or ordinances, including securing of any necessary disposal permits. Any small debris (chips, shavings, etc.) remaining after removal may be buried with Owner approval in non-play areas as identified by the Owner and must be covered with a minimum 24" of compacted fill. Where such materials are buried, strip and replace topsoil per prescribed depths and specifications.

1.03 STRIPPING TURF, SAND AND TOPSOIL

A. Stripping Turf Areas. Roto-till turf in designated areas utilizing a minimum of two passes or as otherwise necessary to sufficiently eradicate and pulverize.

B. Sand from Bunkers and Greens. Remove excess sand from bunkers to designated on-site fill areas or incorporate into the subgrade soil. No soil shall be removed from the site without written approval of Owner.

C. Stripping Topsoil. Strip topsoil to minimum six (6) inches in depth in all areas to be regraded, resurfaced, paved, or disturbed within contract limits work area and as provided for in drawings.

D. Topsoil Stockpile. Stockpile topsoil in a location acceptable to the Owner and the Golf Course Architect, for placement during finish grading and preparation or roughs, fairways, or planting beds. Stockpiled topsoil shall be free from trash, brush, stones over three (3) inches diameter, and other foreign matter. Grade and slope stockpiles to maintain drainage and to prevent erosion. No topsoil shall be removed from the site without written approval of Owner or the Golf Course Architect. All stockpile areas shall be located within construction limits in locations determined by the Contractor and shall not visually interfere with site features or the ability for the Golf Course Architect and Owner to review feature shaping.

1.04 SITE IMPROVEMENTS

A. Existing Utilities or Services. Perform work and provide necessary materials to protect, disconnect or relocate existing utilities or services as indicated. Submit to Owner a record of existing termination points before disconnecting.

B. Sidewalk, Cartpath, or Curb Removal. Remove existing sidewalks, paving, cartpaths, or curbing including base material, if present, as required to permit forming and installation of new work as shown by drawings. Cut existing sidewalks or paving in neat, straight lines at existing expansion or control joints to provide uniform, even transition from new to adjacent existing work. All removed material shall be disposed of off-site unless otherwise approved by Owner and/or Golf Course Architect.

C. Drainage Structures. Revise existing catch basins, draintile, or inlet manhole structures to complete work as specified by construction documents.

1.05 FINAL CLEAN UP AND DISPOSAL OF WASTE MATERIALS Comply with Specifications Section 01700.

END OF SECTION

SECTION 02200
EARTHWORK

The Contractor shall provide all labor, materials, and equipment necessary to complete all Earthwork as required by the drawings and specifications.

1.01 GENERAL

A. Earthwork. Perform earthwork as shown and specified. The work includes:

1. Layout of work to be performed.
2. Site grading and filling to elevations, profiles, and contours as shown by working drawings.
3. Subgrade and granular base preparation for structure slabs, walks, and paving.
4. Topsoil placement and finish grading.
5. Feature construction including greens, tees, and bunkers.

B. Quality Assurance. Comply with Specifications Section 01010 and 01400.

C. Materials and Equipment. Comply with Specifications Section 01600.

D. Warranties. Comply with Specifications Section 01700.

1.02 PREPARATION

A. Layout of Work. Prior to any grading operations, all excavation and fill areas shall be staked in the field showing slope stakes, boundary stakes, cut stakes, fill stakes, etc. as required to layout and control the work. Layout shall be subject to review by the Golf Course Architect to check for any abnormalities or needed adjustments to maximize earth moving efficiency.

B. Required Inspection, Tests, Approvals, and Location Recordings. Comply with Specifications Section 01400.

C. Existing Utilities and Services. Comply with Specifications Section 01010.

1.03 SITE GRADING

A. Grading Requirements. Perform grading within contract limits, including adjacent transition areas, to new elevations, levels, profiles, and contours as shown by construction drawings. Provide subgrade surfaces parallel to finish surface grades. Provide uniform levels and slopes between new graded elevations and existing grades. Provide subgrade surface free from irregular surface changes and as follows:

1. Rough grading: Plus or minus 0.10 feet subgrade tolerance. Required surface finish will be that ordinarily obtained from a blade-grader.
2. Provide subgrade surface free of exposed boulders or stones exceeding 4" in greatest dimension in paved areas and 2" in turf and planting areas.
3. Paved areas: Shape surface of subgrade areas to alignment, grade, and cross-section indicated by working drawings. Compact subgrade, as required, to receive paving base materials. Subgrade tolerance plus or minus .10 feet.
4. Granular Base: Grade subgrade surface smooth and even, free of voids to the required subgrade elevation. Provide compacted subgrade suitable to receive granular base materials. Tolerance 1/2" in 10'-0".

B. Drainage. Grade surface to provide drainage away from site structures and golf course features, and to prevent ponding and pockets in surface drainage. Provide necessary pumps and drainage lines to maintain excavated area free of water, ice, and snow during construction operations.

1.04 EXCAVATING

A. Excavation. All on-site excavation of materials encountered within the project area shall be performed to the subgrade lines and grades shown on the drawings. Proposed lines and grades shown on the drawings are to finish grade. The Contractor shall refer to the drawings and specifications for necessary information to calculate subgrade elevations throughout the site. The Owner reserves the right to review all excavated material for quality and declare first refusal of sub-standard soil in critical fill areas.

B. Over-Excavating. In the event that excavations are made below the subgrade elevations, the Contractor shall replace the excavated material in horizontal lifts not to exceed eight (8) inches (loose measurement) as specified for embankments. Placed material shall be compacted to a degree consistent with surrounding undisturbed material.

C. Extra Excavation. Excavate unsatisfactory soil materials extending below required elevations to depth as shown by working drawings. Replace with suitable backfill material per Specifications Section 01600 in horizontal lifts not to exceed eight (8) inches (loose measurement). Placed material shall be compacted to a degree consistent with surrounding undisturbed material.

D. Excavation of Golf Course Features. Excavate greens, tees, and bunkers to elevations and dimension shown on working drawings.

E. Excavation for Walks and Cartpaths. Excavate for cartpaths to elevations and grades indicated on working drawings. If required by drawings and specifications, excavate to provide for placement of base material.

1.05 EMBANKMENT

A. Subgrade Embankments. Subgrade embankments shall be constructed, after plowing or scarifying the natural ground surface to a depth of 6", by depositing and compacting suitable backfill material per Specifications Section 01600. Construction to be in accordance with subgrade lines and grades on the drawings.

B. Fill Material. All fill materials shall comply with Specifications Section 01600. All fills, especially those under fairway, tee, bunker or green features, must be built from suitable soils and using methods that minimize settling and allow for proper finish work. Any methods such as material segregation, drying and/or dewatering deemed necessary to ensure soil stability and workability are the responsibility of the Contractor, who will ultimately be responsible for working the soil to a finish grade and fixing any settling areas that occur during post construction warranty period. The Owner reserves the right to review all excavated material for quality and declare first refusal of sub-standard soil in critical fill areas.

1. Fill shall be loosely placed in horizontal lifts so that the successive lifts shall blend together. The maximum thickness per lift of compacted fill shall not exceed 8”. Each layer of fill shall be compacted evenly and densely by distributing the movement of the construction equipment uniformly over the entire embankment area. The material in each layer shall have the proper moisture content to obtain compaction. When too dry, water shall be added; when too wet, the material shall be aerated. Materials placed by dumping in piles or windrows shall be spread uniformly to not more than 8” thickness before being compacted.

2. Suspend fill operations when satisfactory results cannot be obtained because of environmental or other unsatisfactory site conditions. Do not use muddy or frozen fill materials. Do not place fill material on muddy or frozen subgrade surface. Maintain adequate drainage of rainwater and prevent ponding of surface water in pockets. When fill placement is interrupted by rain, remove wet surface materials or permit materials to dry before placement.

C. Soil Stabilization. When exposed subgrade surfaces become spongy during construction operations and soil stabilization is required, stabilize subgrade materials as directed by a Soil Engineer. Soil stabilization will be paid for as a change in work. Obtain Owner and/or Golf Course Architect's written authorization before performing soil stabilization work.

D. Settlement Areas. Fill and compact all areas of settlement to proper grade before subsequent construction operations are performed.

E. Backfilling. Place backfill materials in uniform layers no greater than 8" loose thickness over entire backfill area. Use hand tamping or vibrating compactors at foundation walls, retaining walls, and similar locations. Do not use large rolling equipment adjacent to foundation walls and retaining walls. Do not backfill against foundation walls or retaining walls until walls for bearing surface have reached design strength or are properly braced, and backfilling operations approved by Owner or Architect. Provide suitable backfill materials compliant with Specifications Section 01600.

F. Granular Base. Provide minimum 4-inch depth of granular base under structure concrete slab-on-grade for the hitting station area in the driving range. Granular base material per Specifications Section 01600.

1.06 FINISH GRADING

A. Topsoil Replacement. Uniformly distribute and spread stockpiled topsoil to a minimum compacted depth of 6”. Use loose, dry topsoil. Do not use frozen or muddy topsoil. Place during dry weather.

1. No spreading of topsoil will be permitted until subgrade is approved by Golf Course Architect.
2. Fine grade topsoil to eliminate rough and low areas ensuring positive drainage. Maintain levels, profiles, and contours of subgrade as shown or specified on working drawings.
3. Remove stones, roots, weeds, and debris while spreading topsoil materials. Rake surface clean of stones 1 inches or larger in any dimension and all other debris. Provide surface suitable for soil preparation as specified for seeding and sodding work.
4. Soil compacted by construction equipment or soil on compacted slopes or grades shall be scarified to a minimum depth of 2 inches before applying topsoil to blend the topsoil in, eliminate a layering effect, and reduce erosion and sloughing away.

B. Greens and Tees. All tees and putting surfaces shall be graded to conform to the lines, grades, and cross sections as shown on the drawings and shall be subject to review by the Golf Course Architect. Finish surfaces shall be compacted to the degree necessary to prevent future settling. A uniform layer of 6" suitable topsoil shall be placed on all banks. Unless otherwise required by the construction documents, the upper layer(s) of teeing and putting surface shall consist of a mixture of materials as specified in Specifications Section 01600 and as depicted by the drawings.

C. Bunkers. All bunkers shall be graded to conform to the lines, grades, and cross sections as shown on the drawings and shall be subject to review by the Golf Course Architect. Finish surfaces shall be compacted to the degree necessary to prevent future settling. A minimum depth of 6” of suitable topsoil shall be placed over the subgrade around the entire bunker, after approval of the subgrade by the Golf Course Architect. Sand bunkers are to be vertically edged to a depth of 6” along their inside margin prior to final cleaning, unless otherwise depicted by the drawings. Bunker bottoms shall be excavated properly to account for

bunker liner depths, cleaned by hand raking, and rolled firm and smooth preceding placement of draintile, liner and sand. Sand shall be installed to a 4" compacted depth along all bunker edges and flashed faces and 6" compacted depth along bunker bottoms, unless otherwise depicted by the drawings.

1.07 FIELD QUALITY CONTROL Comply with Specifications Section 01400.

1.08 FINAL CLEAN UP AND DISPOSAL OF WASTE MATERIALS Comply with Specifications Section 01700.

End of Section

SECTION 02400
DRAINAGE

The Contractor shall provide all labor, materials, and equipment necessary to furnish and install all the drainage systems as required by the drawings and specifications.

1.01 GENERAL

A. Drainage. Provide site drainage as shown and specified. The work includes:

1. Site drainage structures and piping.
2. Subdrainage systems.
3. Excavating and backfilling drainage work.

B. Quality Assurance. Comply with Specifications Section 01010 and 01400..

C. Materials and Equipment. Comply with Specifications Section 01600.

D. Warranties. Comply with Specifications Section 01700.

E. Earthwork Operations. Coordinate installation of the site drainage system with excavating and backfilling work performed under Specifications Section 02200, Earthwork.

1.02 PREPARATION AND INSPECTIONS

A. Project Layout. Layout drainage work and establish extent of excavation by area and elevation. Designate and identify datum elevation and project engineering reference points. Set required lines, levels, and elevations. Review all outlet locations to ensure adequate depths for proper tie-in.

B. Site Examination. Comply with Specifications Section 01010.

C. Existing Utilities. Comply with Specifications Section 01010.

D. Inspections and Testing. Comply with Specifications Section 01400.

E. Infiltration. It shall be the intention of these specifications to secure a subdrainage system with a minimum amount of infiltration. The joints shall be tight, and visible leakage in the joints shall be repaired at the Contractors expense by any means found to be necessary.

1.03 GENERAL INSTALLATION (4" PIPE AND LARGER)

A. Trenching and Excavation. No trenching will be allowed more than 300 feet in advance of pipe laying. All trenches shall be completed and backfilled each day. Provide trench wall support, bracing and pumping of surface or ground water as required to provide suitable conditions for performing the work. The width of the trench at the top of the pipe shall be sufficient to permit thorough tamping of the backfill under the haunches and around the pipe, but shall not exceed external diameter of the pipe by 8" on either side.

B. Unsuitable Soil. Where a firm foundation is not encountered at required grade, due to soft, spongy, or unsuitable soil, all such unsuitable soil under the pipe and for the width of the trench shall be removed below grade and replace with a cushion of well compacted granular backfill having a thickness under the pipe of not less than 4".

C. Trenching across Existing Turf. When new drainage pipe runs across existing turf, the sod shall be stripped and replaced with the same sod once the pipe is installed and backfilled. If existing sod is not salvageable it shall be replaced with new sod. Contractor shall notify Owner and/or Golf Course Architect of marginal turf quality prior to stripping.

D. Location. Draintile shall be located true to line and grade in the places specified by the drawings. Where deviations exist between the plan and field locations, such deviations must be brought to the attention of the Owner and/or Golf Course Architect. Draintile shall be installed in features in accordance with plan details, or as otherwise approved by the Golf Course Architect.

E. Staging and Delivery. All site drainage pipe, manholes, and appurtenances shall be laid true to line and grade in trenches and tunnels as specified. All pipe shall be staged as close to the ditch line as safety and operations permit. Pipe shall not be thrown or dropped from vehicles or equipment beds, all pipe must be lowered into the trench with suitable apparatus for the purpose. Damaged material shall be replaced at Contractor's expense.

F. Laying Solid Drainage Pipe. All pipe laying shall commence at the lower end of the line and proceed upgrade. Bell and spigot pattern pipe shall be laid with the bell end upgrade. Tongue and groove type pipe shall be placed with the groove end upgrade. Pipe shall be fitted, matched, and jointed to form a continuous sewer or drain with a smooth uniform invert. As each length of pipe is placed, the mouth of the pipe shall be protected to prevent the entrance of earth or bedding material. Do not place pipe in water, or place pipe when trench or weather is unsuitable for site drainage work. Install pipe joint gaskets in accordance with manufacturer's recommendations. Cut pipe ends entering structures flush with inner face of structures and secure with hydraulic cement or foam, unless otherwise specified by the plans. Obtain required inspections and perform testing prior to backfilling. Remove obstructions, replace damaged components, and retest as required. Provide a satisfactory free flowing site drainage system.

G. Laying Perforated Draintile. Perforated tile drains shall be laid on a firm, undisturbed layer of bedding material (as indicated by plans and Specifications Section 01600) to reduce possible wash of subgrade soil up into tile line by fast water flow. If over-digging occurs, all loosened dirt must be removed and the trench bottom returned to grade with suitable backfill material. Lay draintile with joints closed, and firmly bedded in drainage fill material. Provide full bearing for each pipe section. Provide continuous slope in the direction of flow with minimum fall equal to 0.5%. Provide collars and couplings for all in-line joints and ell, elbow, or bend section for all corners and changes in direction. Provide imperforated run out pipe and extend to out fall connection or daylight as specified by drawings.

H. Connections. The junction of two or more draintiles shall be made in strict conformance with the contract drawings and in accordance with manufacturer’s recommendations. The cost of all connections shall be included in the contract price for new pipe unless otherwise specifically provided for in the contract. Prior to tie-in, test all existing drainage basins and pipes being used as outlets for new drainage to ensure their functionality. Any non-functioning outlets must be reported to Owner.

I. Drainage Structure Construction. Construct catch basins, manholes, inspection risers and other drainage structures as shown on drawings.

J. Backfilling. Backfill trenches with suitable backfill materials compliant with Section 01600, Material Specifications. For solid pipe, backfill trenches in 8" compacted layers to subgrade surface, ensuring a cover of not less than 18" over piping, unless otherwise indicated by the plans. Backfill evenly on both sides of piping for its full depth. Provide thorough compaction of fill under pipe haunches. All perforated tile drains, when placed, shall have the space between the pipe and the bottom and sides of the trench backfilled with aggregate material per Specifications Section 01600. Thoroughly tamp with a shovel, hoe, or light tamper as placed to a minimum of 2" over top of tile, or as otherwise specified by drawings.

K. Restoration of Surfaces. Any settlement of the backfill below the original ground surface shall be remedied by the Contractor per Specifications Section 01700. Replace paving, turf and finishing surfaces disturbed to accommodate the subdrainage system as specified in applicable sections of these specifications, except where new surfaces are provided as part of the work.

1.04 SLIT DRAINAGE INSTALLATION (2")

A. Greens. On new greens construction, all work as listed shall be completed in totality prior to placement of top mix. For existing greens being resurfaced, all work shall be completed prior to related re-grassing process. Otherwise, the process of installing subsurface slit drainage in greens shall be as follows:

1. Layout drainage system on a 10' spacing ensuring minimum 1% positive grade on all mainlines and laterals. Confirm drainage layout with Owner and/or Golf Course Architect prior to starting installation.
2. Trench a minimum of 14" deep and 3"-4" wide with laser grade control. Trencher shall be rubber tired or rubber tracked and operated on plywood. Contain all excavated trench spoils on plywood (or equivalent), not allowing to touch green surface. Hand shovel all excavated material into small trailers for use or disposal on site, as directed by Owner and/or Golf Course Architect.
3. Install 2" drain tile including all connections, flushouts and observation risers. Backfill in lifts with specified sand mix and compact to ensure no trench settling (see Specifications Section 01600 for all materials).

B. Fairways. All fairway slit drainage installation shall be coordinated with other construction and drainage work. Keep work areas dry and free from irrigation while work is completed.

1. Layout drainage system on 12' spacing, or as otherwise depicted by the plans, ensuring minimum 1% positive grade on all mainlines and laterals.
2. Strip existing sod maximum 12" wide and ¾" deep. If existing turf is not healthy or cohesive enough to be stripped and replaced, notify the Owner and/or Golf Course Architect immediately that additional sod may be required upon replacement.
3. Trench a minimum of 18"-24" deep and 4"-6" wide with laser grade control. Tractor pulled trenchers with conveyor systems may be used as long as existing turf is protected from any damage. Backfill with straight sand, materials per Specifications Section 01600
4. Replace sod with no gaps greater than ½". If new sod is necessary, replace with borrowed (on-site) or purchased sod that most closely matches existing turf species, per Owner's approval.

1.05 CLEAN UP AND DISPOSAL OF WASTE MATERIALS Comply with Specifications Section 01700.

End of Section

SECTION 02485
GRASSING

The Contractor shall provide all labor, materials, and equipment necessary to furnish and install all grass as required by the drawings and specifications.

1.01 GENERAL

A. Grassing. Provide seeded and (or) sodded turf areas as shown and specified. The work includes:

1. Soil preparation
2. Seed and (or) sod fairways, rough, greens, tees, and other indicated areas
3. Mulch and blanket
4. Reconditioning existing turf areas

B. Quality Assurance. Comply with Specifications Section 01010 and 01400.

C. Submittals. Comply with Specifications Section 01300.

D. Materials and Equipment. Comply with Specifications Section 01600.

E. Warranties. Comply with Specifications Section 01700.

1.02 PREPARATION

A. Timing. Perform seed and (or) sodding work only after tree planting and all other work affecting ground surface has been completed.

B. Irrigation System. The irrigation system will be installed prior to grassing operations. Locate, protect, and maintain the irrigation system during grassing operations. Repair irrigation system components damaged during grassing operations at Contractor's expense.

C. Layout and Preparation. All final feature layout shall be completed and/or approved by the Golf Course Architect prior to commencement of planting operations. Limit preparation to area which will be immediately grassed.

D. Topsoil. Loosen topsoil to minimum depth of 4". Remove stones over 1" in any dimension and sticks, roots, rubbish, and extraneous matter. Dispose of all collected material in a manner approved by the Owner and/or Golf Course Architect.

E. Fine Grade. Grade area to a smooth, free draining, even surface with a loose, moderately course texture. Roll and rake, remove ridges, and fill depressions as required to drain.

F. Starter Fertilizer. Apply starter fertilizer, as required, within two days prior to grassing, thoroughly and evenly incorporating into the top 1”. Lightly rake until the finished grade is smooth, loose, and pulverized.

G. Soil Preparation. Following applications of fertilizer, compact planting area by making two passes with a culti-packer, or approved similar equipment, weighing at least 90 pounds per linear ft of roller. Make the second pass with a culti-packer at right angles to the first pass. Following compaction, clear the surface of any remaining rock (1” or larger), roots, sticks or debris that might interfere with maintaining turf at anticipated playing heights of cut. Clean-up work area at any stage of construction as long as the final end result is produced.

1.03 INSTALLATION

A. Sodding. Immediately prior to, but not in excess of 24 hours before placing the sod, work the soil surface until it is in a satisfactory condition per preparation requirements. Rework any prepared surfaces that become crusted to an acceptable condition for sodding. No sod shall be laid until final outlines have been approved by the Golf Course Architect.

1. When the surface is dry enough to walk on, place the sod on the prepared surface with the edges in close contact and alternate courses staggered at least 12". On all slopes exceeding 5:1, the sod shall be secured with pegs. Plug any openings that may occur with sod, then thoroughly roll and water. Continue watering and general maintenance until work is accepted by the Owner and/or Golf Course Architect in writing, see Specifications Section 01700.

2. Place sod only when the ground is in a workable condition, preferably in temperatures < 90-degrees F. Sod may only be laid in temperatures > 90-degrees F provided that irrigation is in working order and Owner is notified and approves of such. Sod shall not be placed when the sod or ground surface is frozen or during an extended drought.

3. Protect all areas designated to be sodded against damage from the time work is started until the date of acceptance by the Owner, in writing. Move heavy equipment or materials over lawn areas on planks, and only if necessary. Repair any damage by heavy equipment or other movement over the planted area by preparing, grading, levelling and replanting.

B. Seeding. Seed immediately after preparation of bed. Optimal seeding period is between August 1 and September 1, or at such other times acceptable to the Owner and/or Golf Course Architect. Perform seeding operations when the soil is dry and when winds do not exceed 10 miles per hour. Sow grass seed at the rate specified in Specifications Section 01600, and apply as follows:

1. Greens and Tees - Following soil preparation and fertilization, sow seed using a hopper type seeder as approved by the Golf Course Architect. Sow in two operations, with one-half of the seed for each area being sown in a direction at 90-degrees (or 45-degrees) to the other half. Following distribution, “dimple” the seed in using the knobbed tires of a sand pro machine, or approved similar equipment, by moving the wheel treads over the entire work area to press the seed into the surface. Do not use the rake implement during this operation and do not exceed 1/8” of soil cover over the seed.

2. Fairways and Roughs - In exposed soil areas, apply seed with a Brillion seeder or approved similar equipment. Install seed evenly by sowing equal half quantities in two directions, at 90-degree (or 45-degree) angles to each other. In existing areas where turf or thatch layer remains, apply seed with slit seeder implement sowing equal half quantities in two directions at 90-degree (or 45-degree) angles to each other.

3. Protect all seeded areas against damage from the time work is started until the date of acceptance by the Owner, in writing. Avoid moving heavy equipment or materials over planted areas. Repair any damage by preparing, grading, levelling and replanting.

C. Mulch. On the same day and immediately following planting operations, cover all indicated slopes/areas with hydraulic mulch as determined in Specifications Section 01600. Mix mulch slurry utilizing a mechanically agitated hydraulic seeding machine, complying with equipment manufacturer's mixing instructions and recommendations. To achieve maximum and most uniform coverage use approved hydraulic seeding machines with fan-type nozzle (50-degree tip) and apply product from opposing directions to soil surface. Rough surfaces (rocky terrain, cat tracked and ripped soils) may require higher application

rates to achieve maximum coverage. Unless otherwise approved, no chemical additives with the exception of fertilizer, soil neutralizers and biostimulant materials should be added to mulch products.

1.04 RECONDITIONING EXISTING LAWNS

A. Damaged Turf Areas. Recondition existing turf areas damaged by construction operations, storage of materials or movement of equipment, per the following methods or as otherwise accepted by the Owner and/or Golf Course Architect:

1. Cultivate bare and compacted areas thoroughly and provide topsoil as needed to fill low areas and meet new finish grades.
2. Remove diseased or unsatisfactory turf areas, do not bury under soil.
3. Remove topsoil containing foreign materials resulting from construction operations, including oil drippings, stone, gravel, and other construction materials.
4. Rake, aerate (if compacted), cultivate soil, fertilize and seed where substantial, but thin turf remains.
5. Provide fertilizer, seed and/or sod as specified and as required to provide a satisfactory reconditioned turf where bare soil exists.
6. Water and maintain newly restored areas until accepted in writing by Owner.

1.05 GUARANTEE AND ACCEPTANCE Comply with Specifications Section 01700.

1.06 FINAL CLEAN UP AND DISPOSAL OF WASTE MATERIALS Comply with Specifications Section 01700.

End of Section

02515
CONCRETE PAVING

The Contractor shall provide all labor, materials, and equipment necessary to furnish and install all concrete pads as required by the drawings and specifications.

1.01 QUALITY ASSURANCE AND TESTING

A. Quality Assurance. Comply with Specifications Section 01010 and Section 01400.

B. Materials. Comply with Specifications Section 01600. **P**rovide material furnished by a bulk concrete producer regularly engaged in the production of concrete paving materials.

1.02 EXECUTION

A. Before pouring, notify Owner for inspection of all areas to receive concrete. Confirm sub-grade surfaces are properly graded and such that resulting concrete surface will drain satisfactorily and suitable to receive concrete specified.

B. Correct, or cause to be corrected, all subgrade areas that are soft or uncompressible and all surfaces or sections holding water, cracked, thin and/or any other defects in material or workmanship.

C. Concrete shall be minimum 3,500 PSI concrete mixed and delivered in accordance with the requirements set forth in Tentative Specifications for Ready-Mixed Concrete (ASTM C94). Add fibermesh reinforcement at 1 lb. per yard.

D. The concrete shall be mixed until there is a uniform distribution of the materials and shall be discharged completely before the mixer is recharged.

E. Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent the separation or loss of materials.

F. Equipment of chuting, pumping and pneumatically conveying concrete shall be of such size and design as to ensure a practically continuous flow of concrete at the delivery and without separation of the materials.

G. Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to re-handling or flowing. The concreting shall be carried on at such a rate that the concrete is at all times plastic and flows readily into the space. No concrete that is partially hardened or been contaminated by foreign materials shall be deposited on the work, nor shall re-tempered concrete be used.

H. All concrete shall be thoroughly consolidated by vibration and/or other suitable means during the operation of placing, and shall be thoroughly worked around reinforcement and embedded fixtures and into the corners of the forms.

I. The use of a slip form paver is acceptable but must be equipped with internal vibration or another approved method of construction.

1.03 WORKMANSHIP

A. Concrete pads shall be built to the dimensions shown on the plan, 4" thick. Provide ¼" per foot cross slope. The surface shall be given a medium broom finish. Control joints shall be cut in 10 foot squares at least 1" deep, expansion joints every 80'. Forms shall remain in place for a minimum of 24 hours after pouring concrete.

B. Contractor to be responsible for any weather damage caused to newly poured concrete.

C. Adequate equipment shall be provided for heating the concrete materials and protecting the concrete during freezing or near-freezing weather. No frozen materials or materials containing ice shall be used, and all materials shall be free from frost.

D. The housing, covering or other protection used in connection with curing shall remain in place and intact at least 24 hours after the artificial heating is discontinued. No dependence shall be placed on salt or other chemicals for the prevention of freezing.

E. Any areas holding water, or areas with excessive cracking, scaling or other surface defects or deformities shall be promptly repaired as approved by the Golf Course Architect and/or Owner.

1.04 FINAL CLEAN UP

A. Clean up and remove from site all concrete "spills", excess concrete from screeding and related debris.

B. Repair any significant damage to grading and other work due to these operations.

C. Contractor will place topsoil and sod along edge of cart paths or as otherwise indicated on the plans.

End of Section

APPENDIX A

*Note: These specifications have been transferred from the recently completed (Fall 2023) irrigation installation project on the Red Pine Golf Course. Some information in these specifications may not apply to the short-game area project, but are included as reference for the Contractor to understand the system being tied into.

SPECIFICATIONS FOR THE AUTOMATIC IRRIGATION (SHORT-GAME AREA)

AT

BRIGHTON DALE LINKS – RED PINE GOLF COURSE
KANSASVILLE, WI

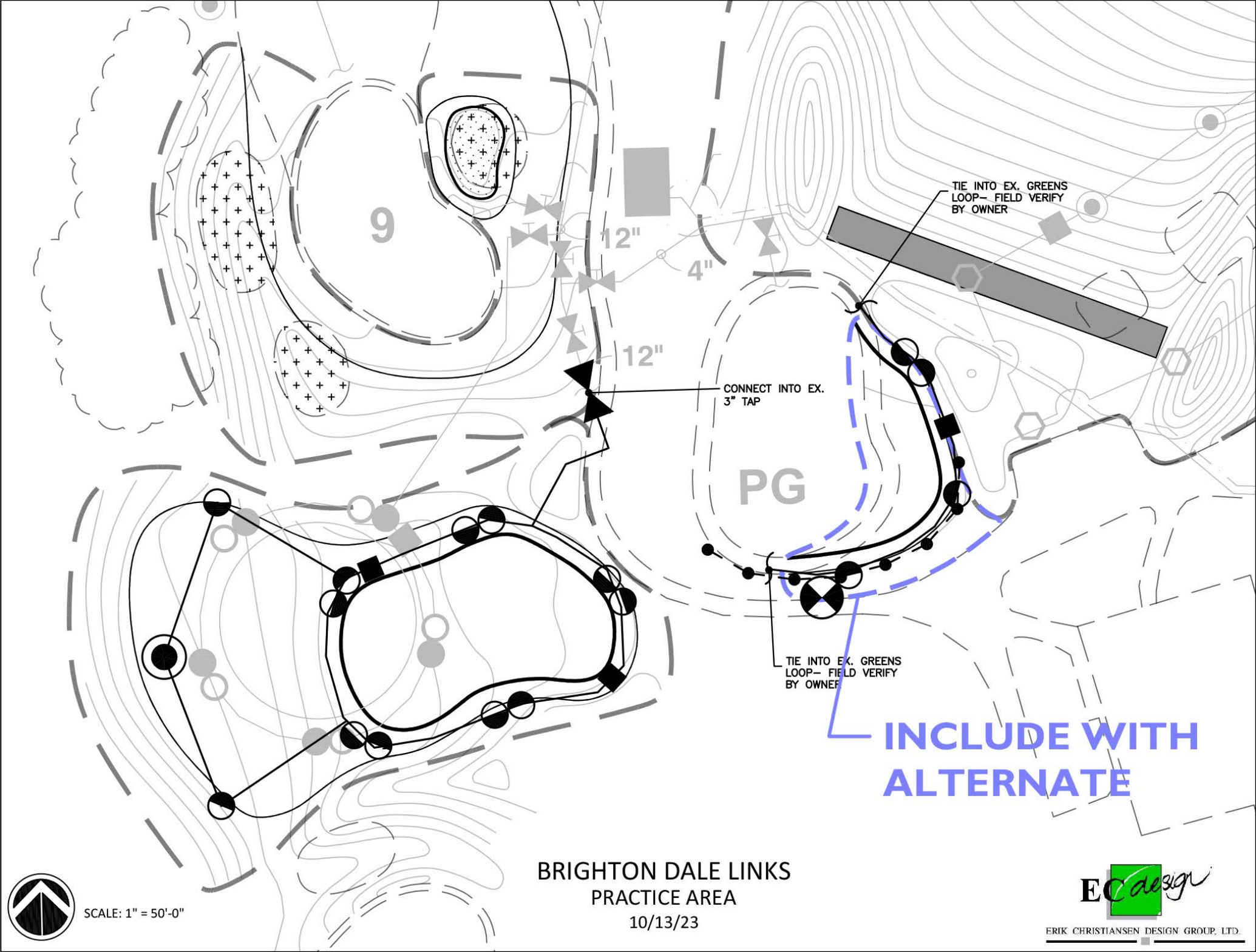
RED NINE IRRIGATION CONSULTANT

EC design

ERIK CHRISTIANSEN DESIGN GROUP, LTD.

BRIGHTON DALE LINKS

ASIC
ERIK CHRISTIANSEN ASIC–PIC
PROFESSIONAL IRRIGATION CONSULTANT



SCALE: 1" = 50'-0"

BRIGHTON DALE LINKS

PRACTICE AREA

10/13/23

ERIK CHRISTIANSEN DESIGN GROUP, LTD.

I. General Conditions

The installation of the Irrigation System will have an Owner's Representative.

Owner's Representatives:
Jim Wallace – Superintendent
Brighton Dale Links - Red Pine Nine
830 248th Avenue
Kansasville, WI 53139
Phone: 262-925-8010
Email: James.Wallace@kenoshacounty.org

Irrigation Consultant:
Erik Christiansen – ASIC, TCEQ
President - EC Design Group, Ltd.
400 5th Street
West Des Moines, IA 50265
Phone: 515-225-6365
Email: erik@ecdesigngroup.com

The objective of these specifications is provide assembled and installed Toro sprinklers, PVC piping and all associated equipment for the proper operation of an automatic sprinkler system on the short-game green. This system, when finished, will efficiently and effectively operate. Said system shall prove to be satisfactory in all aspects to the Owner and Owner's Representative and Irrigation Consultant. These specifications are to be followed with due perseverance in all respects.

The diagrammatic Plans and Specifications contain a design build element and are intended to include everything obviously requested and necessary to do the proper installation of the work, whether each necessary item is mentioned herein or not, unless otherwise specified the contractor is expected to provide for the same.

Irrigation Plans with Specifications are intended to work together and any item or feature called for in one and not the other shall be as binding as if called for in both. If a discrepancy exists between an item called for in the Plan and the Specifications, the Plan takes precedence or the contractor can assume the more stringent as it applies to the best method of operation and installation.

All work specified herein or called for on the drawings shall comply in accordance with all governing ordinances, laws and regulations that apply to the project. If the contractor performs any work contrary to such codes, laws or regulations, they shall assume full responsibility and bear all costs necessary to correct the work, at no additional cost to the Owner or the Owner's Representative.

Bidders must study and compare the Drawings and Project Documents and shall be responsible for discovering and reporting to the Irrigation Consultant any error, omission, inconsistency or other defect that should be apparent to a reasonable prudent Contractor. The Irrigation Consultant will interpret, correct or otherwise clarify the Project Documents as necessary, and will make any interpretation, correction or clarification in writing and issue it an addendum to all Bidders.

Any work undertaken by the Contractor containing possible errors or conflict without or before a written interpretation or instruction by the Owner's Representative and Irrigation Consultant is done so at the Bidders own risk.
The successful Contractor will be required to install the irrigation system under the following requirements:

1. All open trenches and excavations must be marked and protected on a daily basis. Protection will include barriers and plywood covers over excavations and other necessary procedures to protect the public and other Contractors from the danger of construction activities.

2. The entire site must be left in a clean and safe condition at the end of each workday. "Clean and safe" will be at the discretion of the Owner's Representative and the Irrigation Consultant. The Contractor shall appoint a supervisor who shall be responsible for all safety measures, as well as for compliance with all applicable governmental laws, ordinances, rules and regulations such as, for example, "OSHA" and "Right to Know" legislation and all city, county and state codes.
3. The order of work will be as agreed upon with the Irrigation Consultant and Owner's Representative. The resulting agreement shall become the basis for the irrigation part of the master project schedule.
4. Contractor shall keep the existing system up and operating each night to water the entire golf course (as required by Owner) and Contractor shall coordinate with Owner each day as to the status of the existing irrigation system. Furthermore, Contractor shall water all new and replaced turf until time of irrigation system acceptance by Owner and Irrigation Consultant.

The omission of any material from this Specification is not to be interpreted to the effect that omitted material will not be furnished by the Contractor. All material and labor, unless specifically indicated as being furnished by others, must be furnished and installed by the Contractor under the signed agreement.

The Contractor/Owner shall stake or mark out the location of power wire, any mainline and wire paths in the immediate area to be worked on prior to starting installation. In the event there are any discrepancies from the work shown in the plan, the Contractor shall verify the dimensions with the Irrigation Consultant before work may begin in that area.

Routing of the pipe and wire are diagrammatic and the Contractor/Owner will be expected to make field adjustments. The Owner reserves the right to make pipe and/or cable routing changes from those shown in the plans in cases, but not limited to; where ledge, boulders or other obstacles impede the path. Minor changes of this nature shall not affect the cost or time limits of the work.

Valve boxes should be as indicated on the drawings. Communication cable shall not be run through bunkers or tees. No valve boxes shall be located within the fairway cut and shall not be installed in the walking path to or from the green.

Rock, shale, stones, organic matter or trash not suitable for use as backfill shall be dug and hauled to an accessible dumpsite on the property. The Contractor shall be responsible calling in all locates and will be responsible for all damage to underground utilities of which they are aware, including, but not limited to; gas, water, electricity, cable, telephone, under-drains and drain tiles. Coordinate with the Owner's Representative and responsible utility marking firms the locations of existing underground utilities and drains.

The Contractor shall not assign or subcontract any part of the work without the expressed written approval of the Owner prior to the start of said work to be subcontracted. Acceptance of a subcontractor does not relieve the Contractor of his responsibilities under the agreement.

II. Bidding Instructions

Part 1 - General

1.1 QUALIFICATIONS AND INTERPRETATIONS

A. Construction schedules *must be approved by Owner and Owner's Representative(s):*

Owner's Representatives:
Jim Wallace – Superintendent
Brighton Dale Links - Red Pine Nine
830 248th Avenue
Kansasville, WI 53139
Phone: 262-925-8010
Email: James.Wallace@kenoshacounty.org

Irrigation Consultant:
Erik Christiansen – ASIC, TCEQ
President - EC Design Group, Ltd.
400 5th Street
West Des Moines, IA 50265
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1. All proposals must meet the requirements in the Quality Assurance Section IV item 1.30-A.
2. Irrigation said improvements must be completed in the time frame designated by the Owner and Owners Representative.
3. List all, if any, sub-contractors to be employed by the contractor on irrigation project.
4. Acknowledgment of receipt of addenda.
5. Completion of unit pricing.
6. Contract will be awarded, unless all bids are rejected, under normal circumstances, to the responsible Bidder whose bid and accepted alternative bids resulted in the lowest sum.
7. Owner reserves the right to reject any and all bids when such rejection is in the interest of Owner; to reject a bid or a Bidder who has previously failed to perform properly or complete on time contracts of similar nature; to reject bid or a Bidder who is not, in the opinion of the Irrigation Consultant or Owner, in a position to satisfactorily perform the contract. Owner also reserves the right to waive any informalities and technicalities in bidding. Owner may also accept or reject any alternatives.
8. All contractors must visit job site before submitting a bid.

1.2 CONTRACT SPECIFICATIONS

A. The detailed specifications, which follow, shall govern the materials furnished and work performed in the construction of the work covered by this contract.

B. No attempt has been made in the specifications to segregate work to be performed by and trade, subcontract or proposal item, under any one section of the specifications. Any segregation between trade or craft jurisdiction limits, and the establishment of subcontract limits, will be solely a matter of agreement between the Contractor and his employees and his Sub-contractors. The specifications will govern the construction of the entire work and the provisions thereof all govern each item and unit of work to which such provisions apply.

1.3 APPLICATIONS FOR PAYMENT (as per County requirements)

1.4 TERMINATION OF CONTRACT (as per County requirements)

1.5 LIQUIDATED DAMAGES (as per County requirements)

1.6 CONTRACTOR'S LIABILITY INSURANCE (as per County requirements)

1.7 BID FORM (see County specifications)

STATEMENT OF EXPERIENCE

The Bidder shall list golf irrigation installation projects and references for which he provided services of a similar scope and magnitude to the subject project. The Contractor shall include a minimum of five projects within the past three (3) years that include irrigation installation utilizing HDPE main line and lateral piping.

Project and Location	Contract Amount	Reference and Phone No.
1.		
2.		
3.		
4.		
5.		

III. Project Close-out

1.1 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following:
   1. Remove temporary facilities from the site.
   2. Complete final cleaning requirements as described below in this Section.
   3. If 100 percent (100%) completion cannot be shown, prepare a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.

B. Inspection Procedures: On receipt of a request for inspection, the Owner will either proceed with inspection or advise the Contractor of unfulfilled requirements. The Owner will either prepare the Certificate of Substantial Completion following inspection or advise the Contractor of work that must be completed or corrected before the certificate will be issued.
   1. If Owner indicates items to be completed before the Certificate of Substantial Completion can be issued, then the Owner will repeat inspection when requested and assured that the Work has been substantially completed. Total cost of re-inspections will be borne by the Contractor.
   2. Results of the completed inspection will form the basis of requirements for final acceptance.

C. In accordance with any pertinent section under separate cover.

1.2 FINAL ACCEPTANCE

A. Re-inspection Procedure: The Owner will re-inspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed.

B. Upon completion of re-inspection, the Owner will prepare a certificate of final acceptance, or advice the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance. If necessary, re-inspection will be repeated. Total cost of re-inspection will be borne by the Contractor.

C. In accordance with any pertinent section under separate cover.

1.3 FINAL PAYMENT REQUEST (as per County requirements)

IV. Irrigation System

Part 1 - General

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including Bidding Requirements apply to work specified in this Section.

1.2 DESCRIPTION

A. Provide all labor, materials, equipment and supervision required to construct an underground irrigation system as shown and specified. The following work includes; but not limited to:
   1. Sprinklers.
   3. Testing.
   4. Excavation and backfilling irrigation system work.
   5. Associated HDPE plumbing/fusion by certified HDPE fusion contractor as per specifications and accessories to complete the system.
   6. Wire sleeves (as required).

1.3 QUALITY ASSURANCE

A. Installer's qualifications: Minimum of 12 years experience installing golf course irrigation systems of comparable size. A minimum of 5 similar golf courses completed within the last 3 years.

B. Materials, equipment, and methods of installation shall comply with, but not limited to, the following codes and standards:
   1. All local and state laws and ordinances, and with all the established codes applicable thereto.
   2. American Society of Irrigation Consultants (ASIC)
   3. National Fire Protection Association (NFPA);
   4. National Electrical Code (NEC).
   5. American Society for Testing and Materials (ASTM).
   6. National Sanitation Foundation (NSF).
   7. The Irrigation Association (IA).

C. The Contractor shall take out all required permits, arrange for all necessary inspections and shall pay any fees and expenses in conjunction with the same as a part of the work under this Section.

D. Excavating, backfilling, and compacting operations: Comply with execution requirements and as specified.

E. Contractor/Owner to complete all layout work.

F. Obtain Irrigation Consultant's acceptance of installed and tested irrigation system prior to installing backfill materials.

1.4 SUBMITTALS

A. Submit manufacturer's product data and installation instructions for each of the system components.

C. Submit the following material samples:
   1. Wire, wire connectors and sealer.

D. Submit the following equipment samples to Owner:
   1. Valves and valve access boxes, if applicable.

E. Approved equipment samples will be returned to Contractor and may be used in the work.

F. Provide irrigation system record drawings:
   1. The record as-built drawings shall be the original plan of the irrigation system as constructed. The final as-built drawings shall be prepared electronically at a scale of 1" = 100'. The drawings shall consist of a piping plan, a schedule plan, and a wiring plan, indicating the location, type and size of all wires, valves and other fittings. The drawing shall show all electronic controls, connections and wire splices. Measurements shall be indicated on the plan between sprinklers and valves. All pertinent materials shall be dimensioned from three fixed objects (i.e., drain valves, lateral isolation valves, mainline isolation valves, and wire splice connections). Station numbers shall be indicated on the drawings.
   2. The as-built drawings shall be made by an agent of the Contractor who shall utilize engineering skills and procedures in a manner satisfactory to the Owner's Representative in accomplishing his work. The record drawings shall be kept clean, dry and safe from damage at all times. The drawings shall be brought up-to-date at the close of each working day, and shall accurately indicate the location of all equipment placed to that time. In addition, a copy of the as-built drawing shall be mailed or delivered to the Owner's Representative every two weeks during the construction period. **No final approval will be given until the Owner approves the as-built drawings. Final "as-builts" shall be delivered electronically on 2019 AutoCAD .dwg or newer.**
   3. Identify field changes of dimension and detail and changes made by Change Order.
   4. **GPS irrigation collection by the Irrigation Consultant does not remove the obligation of the Contractor to produce all "as-built" scaled drawings as stated above.**

1.5 DELIVERY, LANDS FOR STORAGE AND HANDLING

A. Deliver irrigation system components in manufacturer's original undamaged and unopened containers with labels intact and legible.

B. Deliver plastic piping in bundles, packaged to provide adequate protection of pipe ends.

C. Store and handle materials to prevent damage and deterioration. Store materials in locations designated and approved by the Owner.

D. Provide secure, locked storage for wire and similar components that cannot be immediately replaced, to prevent theft and therefore avoid installation delays.

E. Contractor has the right to a temporary construction facility for storage and protection of materials.

1.6 PROJECT CONDITIONS

A. Prior to any excavation at the site, contractor shall examine any applicable drawings, if any available from the Owner and/or Irrigation Consultant and consult with Owner's personnel and utility company's representatives to determine possible utility locations and depths. No compensation will be allowed for damage to existing utilities and systems.
B. Take precautions to ensure that equipment and vehicles do not disturb or damage existing site grading, walks, curbs, pavements, utilities, plants, and other existing items and elements on public and private property.
C. Promptly repair damages to adjacent facilities caused by irrigation system work operations. Cost of repairs at Contractor's expense.
D. Promptly notify the Irrigation Consultant of unexpected sub-surface conditions.
E. **Irrigation system layout is diagrammatic**. Exact locations of piping, valves, wire and other components shall be established by Contractor/Owner in the field at time of installation and approved by the Owner or the Owners Representative before installation.
    1. Minor adjustments in system layout will be permitted to clear existing fixed obstructions.
F. Cutting and patching (cart paths, walks, drives, walls etc):
    1. Cut through concrete and masonry with core drills. Jackhammers are not permitted.
    2. Materials and finishes for patching shall match existing cut surface materials and finish. Exercise special care to provide patching at openings in exterior wall watertight.
    3. Methods and materials used for cutting and patching shall be acceptable to the Owner and Irrigation Consultant.
G. Protection of Persons and Property:
    1. Barricade open excavations occurring as part of this work and post warning lights.
    2. Operate warning lights as recommended by authorities having jurisdiction.
    3. Protect structures, utilities, sidewalks, pavements, curbs and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by this work.

.7 GUARANTEE

A. For a period of one (1) year from date of **final acceptance** of work performed under this Section, the Contractor shall promptly furnish and install any and all parts and equipment which prove defective in material, workmanship or install at no additional cost to the Owner except trench settling and any pipe/fittings failures will be guaranteed for (2) years.

Part 2 - Products

2.1 ACCEPTABLE MANUFACTURERS

A. THE TORO COMPANY, IRRIGATION DIVISION, RIVERSIDE, CA

2.2 MATERIALS

A. General:
   1. Provide only new materials, without flaws or defects and of the highest quality of their specified class and kind.
   2. Comply with pipe sizes indicated. No substitution of smaller pipes will be permitted. Larger sizes may be used subject to acceptance of the Irrigation Consultant. Remove damaged and defective pipe.
   3. Provide pipe continuously and permanently marked with manufacturer's name or trademark, size, schedule and type of pipe, working pressure at 73 º F. and National Sanitation Foundation (NSF) approval.
   4. **All pipe and fittings (HDPE) shall be supplied from the same manufacturer throughout the entire job.**
   5. **All sprinkler equipment must be purchased by the local authorized servicing regional distributor.**

B. Irrigation Mains/Laterals - PVC pipe, fittings and connections:
   1. Polyvinyl chloride pipe: ASTM D2241 NSF-PW, rigid, un-plasticized PVC, extruded from virgin parent material. Provide pipe homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, wrinkles and dents.
   2. Gasketed pipe shall be used for 3" and larger diameter pipe. Gasketed pipe or bell end pipe to be used for 2" through 2-½" diameter pipe – **depending on actual method of installation**.
   3. All pipe 2" diameter and over, shall be SDR 21, Class 200 unless noted on plan.
   4. Glued PVC pipe fittings: ASTM D2241 schedule 80 PVC molded fitting suitable for solvent weld, slip joint ring tight seal. Screwed connections shall be Sch 80 PVC with no male adapters. Fittings made of other materials are not permitted.
      a. Size slip fitting socket taper to permit a dry un-softened pipe-end to be inserted no more than halfway into the socket. Saddle and cross fittings are not permitted.
      b. All threaded PVC connections shall be made using Sch. 80 toe nipples and Sch. 80 couplers or socket fittings (where applicable). No threaded Sch. 80 fittings or male adapters.
      c. PVC solvent shall conform to ASTM D2564 and is NSF approved for potable applications. Proper solvent shall be used for diameter of piping being glued. All solvent weld joints must set for 24 hours before being installed and be done in accordance with all manufacturer recommendations.
   5. Ductile Iron fittings:
      a. Golf Grade Ductile Iron Deep Bell ductile iron fittings.
      b. Fittings shall be manufactured of ductile iron, Grade 65-45-12 in accordance with ASTM A-536. Fittings shall have deep bell push-on joints with gaskets meeting ASTM F-477.
      c. Golf Grade Deep Bell fittings shall be used on all PVC mainlines and lateral piping 2 ½" in diameter and larger.
   6. Swing Joints:
      a. Toro/Lasco (or equal) 360º swing joint assembly. Contractor is responsible for proper installation of swing joints due to actual lateral depths lay lengths (as per manufacturer recommendations).
   7. Service Tees:

a. HARCO PVC Class 200 service tee as manufactured by The Harrington Corporation of Lynchburg, VA or Sch. 80 SxSxACME. **Note – all fittings must be approved in the submittal process as well as style of lateral installation.**

b. Shall be located under all sprinkler heads and quick coupler valves **with appropriate thrust blocks at all change of directions and dead ends, laterals and mains.** (see detail)

8. Gasket Lubricant:
   a. Lubricant for assembling pipe and fittings shall be water soluble, non-toxic, non-objectionable to taste and odor imparted to the fluid, non-supporting of bacteria growth, and have no deteriorating effect on the PVC or rubber gasket. All pipe, couplings, rubber rings and lubricant shall be furnished by the same pipe manufacturer or as expressly recommended by them for use with their product.
9. "Air Release Valves":
   a. Air release valves shall be installed at high points on golf course and/or where diagrammatically noted on irrigation plan. Irrigation plan locations are diagrammatic; Contractor will be responsible for proper location as approved by Irrigation Consultant. Air release valves shall be installed in a Jumbo valve box and plumbed with a ball valve and wye strainer to isolate for maintenance (see detail).

C. V-I-H sprinklers, valves and associated equipment:
1. Products and associated equipment are to be provided by only one manufacturer for the complete project. Refer to the drawings for the quantity and diagrammatic locations of the following:
2. Sprinkler heads with swing joint assemblies – see detail:
   a. TORO INF54/55 V-I-H Series (see drawings)
   b. Spacing of heads shall not exceed manufacturer's maximum recommendations. Conform to manufacturer's specifications concerning diameter of throw and gallonage at given pressures.
3. Electric & Manual Isolation Valves:
   a. Rt/RW "resilient wedge" (or equal)-see plan
   b. 2" Harco/Leemco 90° PE lateral isolation valve – see plan.
   c. Size isolation valves to match line size-Manual Valves only.
   d. Installed in specified valve access box.
   e. Each style of isolation valve shall have (2) 4'-0" tee handle keys supplied by Irrigation Contractor.
4. Quick Coupler Valves:
   a. Toro 1" QCV with stabilizer and swing joint assembly.
   b. Provide matching quick coupler keys – (10) included in base bid – see spare parts section.
   c. Installed as specified on detail plan.
   d. All Q.C.V. shall be plumbed with a **1" brass insert swing joint with stabilizer.**

D. Control Equipment: N/A

E. Primary Electrical Wire:
1. Type "UF", 600 volt, solid copper, single conductor wire with PVC insulation and bear "UL" approval for direct underground burial feeder cable with ground in conduit.
2. Size #00 Gauge - #12 Gauge. – (See Plan and Section V, 2.1)

F. Secondary Control Wire:
1. Electrical control and ground wire: Type "PE" 600 volt, solid copper, single conductor wire with polyethylene insulation "UL" approved for direct

underground burial feeder cable. 12 gauge white common neutral and 14 gauge red control wire.

2. Wire color code: Provide color or "hot" wires red in color. Provide "common" wires white in color (one hot wire per head wire back to satellite). See plan and Section V, 2.2
3. No aluminum wire allowed.

G. Controller Communication Wire: **None – R.F.**

2.3 ADDITIONAL MATERIALS

A. Primary Electric wire connectors: **(as per manufacturer's recommendations)**
   1. 3M COMPANY DBR-6 splice kits Socket seal type wire connectors or scotchcast and waterproof sealer, or Large 3M #4 Resin Bag UL listed for 600 volts and underground splice. All electrical connections shall apply to NEC standards and all local, state and federal codes whether listed or not or as per manufacturers latest standards.

B. Secondary Control Wire connectors:
   1. 3M COMPANY #3570G-N direct burial splice kits. All electrical connections shall apply to NEC standards and all local, state and federal codes whether listed or not.

C. Valve Access Boxes:
   1. Standard or Jumbo Box with extension kit-or equal; for air relief valves and isolation valves-See Plan

D. Thrust Blocking:
   1. Thrust blocks are anchors placed between pipe or fittings and the solid/virgin trench wall. Specified blocking of concrete which is calculated to have a compression strength of 2,000 pounds per square inch. The mixture is one part cement, two parts washed sand and five parts gravel. Thrust blocks must be constructed so the bearing surface is in direct line with the major force created by the pipe or fitting. See diagram. The earth bearing surface should be undisturbed (virgin wall).
   2. Thrust blocking is to prevent the line from moving when the pressure load is applied, transferring the load from the pipe to a wide load bearing surface. Thrust blocks are required where fittings are used to change direction (i.e. the following but not limited to; all tees, elbows, wyes, caps, valves and reducers etc.) of the pipe line. The thrust blocking must be formed against a solid trench wall (virgin wall) and these fitting areas must be excavated by hand, mechanical equipment will damage the bearing surface of the trench wall.
   3. The size and type of thrust depends on pipe size, line pressure, type of fitting, degree of bend and type of soil. Thrust block size may be calculated by the example procedures shown below.
   4. It will be the responsibility of the Contractor for all change of direction thrust blocks on all size piping. Furthermore, the warranty period for pipe and/or fitting failures is for (2) years from the date of acceptance.

Step 1 – Multiply the pressure level desired for testing by the appropriate value shown in the following table:

Pipe Size	Dead End or Tee	90 deg Elbow	45 deg Elbow	22 ½ deg Elbow
1 ½"	2.94	4.16	2.25	1.15
2"	4.56	6.45	3.50	1.78
2 ½"	6.65	9.40	5.10	2.60
3"	9.80	13.90	7.51	3.82
3 ½"	12.80	18.10	9.81	4.99
4"	16.20	23.00	12.40	6.31
5"	24.70	35.00	18.90	9.63
6"	34.80	49.20	26.70	13.60
8"	59.00	83.50	45.20	23.00
10"	91.50	130.00	70.00	35.80

Step 2 – Determine the bearing strength of the soil from the table below:

Bearing Strength of Soils

Soils and Safe Bearing Loads Lbs. Sq. Ft.	
Sound Shale	10,000
Cemented Gravel and Sand-difficult to pick	4,000
Coarse & Fine Compact Sand	3,000
Medium Clay - Can be spaded	2,000
Soft Clay	1,000
Muck	0

Step 3 – Divide the total thrust obtained in Step 1 by the bearing strength of the soil; this gives the square feet of area needed.

Side Thrust on Curves – An outward pressure exists on all deflections from a straight line. Good soil, properly tamped, can be sufficient to hold side thrust – unless soil conditions are unstable. In that case, to anchor against this side thrust, the blocking should be placed against the pipe on each side of the coupling. Do not thrust block the coupling itself.

Side Thrust

Pipe Size Inches	*Side Thrust Pounds per Degree*
1 ½"	5.1
2"	7.9
2 ½"	11.6
3"	17.1

3 ½"	22.4
4"	28.3
5"	43.1
6"	60.8
8"	103.0
10"	160.0
12"	225.0

Based on side thrust per 100 lb./in² pressure per degree of deflection.

Note: Multiply side thrust pounds by degrees of deflection times pounds of pressure divided by 100 to obtain total side thrust in pounds.

5. 2,000-psi test minimum on thrust block meeting all ASTM specifications C-33 and C-150 or C-175 standards. **Note: Thrust blocks can differ depending on the type of fittings and soils. Contractor must review all conditions for adequate thrust. Furthermore, a joint restraint may be required to obtain and secure a fitting from movement.**

E. Golf Grade Ductile Iron Fittings & Joint Restraints

1. Fittings for bell and gasket pipelines shall be ductile iron, slant-bell design, and deep bell type. Fittings shall be manufactured of ductile iron, grade 65-45-12 in accordance with ASTM A-536. Fitting gaskets shall be in accordance with ASTM F-477. All ductile iron fittings shall be equipped with four 90-degree apart, outwardly extending radial lugs to accommodate for appropriate method of mechanical restraints.
2. Fittings made from more than one piece shall utilize securely fastened bolt-on style spigot-bell links. Slip-on rings or loose rings as the method of attachment are not permissible.
3. All tee fittings used to connect remote control valve and quick coupling assemblies to the mainline shall be ductile iron, deep bell service tees.
4. All ductile iron bends; reducers, tees and gate valves shall be mechanically restrained. All bell and gasket joints adjacent to restrained joints shall be restrained in accordance to the manufacturers recommended design criteria and guides. **Note: Sites where ductile iron fittings without joint restraints and thrust blocks are acceptable in lieu of joint restraints and/or joint restraints that are used in cases of non-bearing soils or where joint restraints are used exclusively. See plans and details for actual site by site applications.**
5. The mechanical joint restraint shall be capable of securing the PVC pipe directly to the ductile iron fitting without the use of bolts, links and adapters. The joint restraint shall be capable of securing PVC gasket pipe joints and gate valves without use of threaded rods. Joint restraints made for iron or steel pipe are not permissible.
6. The joint restraint shall be manufactured from ductile iron, grade 65-45-12 in accordance with ASTM A-536. Bolts and nuts used on joint restraints shall be provided as part of the restraint assembly. Joint restraints shall be as manufactured by Leemco, Inc.
7. All joint restraints shall be installed using methods recommended by the manufacturer. All bolts and must be tightened as per manufacturer's recommended torque ratings.
8. All tees, bends, reducers and end caps should be restrained using LH Series clamp sets. Additionally, a certain number of bell-spigot joints before and

after a restrained fitting require LB Series joint restraints. There are also LG series clamp kits for restraining slip-on gate valves.

9. The following table lists values for the minimum restrained length of pipe ("L"). Every joint within the distance "L" should be restrained. Bends require that all joints be restrained on both sides of the bend for the specified length. The most critical are capped pipe and gate valves installed at terminating points for future connections; these should be treated as Dead End applications.

Table values are based on 125 psi test pressure, 2 feet cover, sand-clay type soil and safety factor of 2. For pressures other than 125 psi, multiply the "L" values by the actual pressure and divide by 100.

MATERIAL SPECIFICATIONS:
Clamps and Tie Rods: Ductile Iron ASTM A-536
Bolts and Nuts: Low Alloy Steel standard 304 Stainless Steel (Optional)

Pipe Size (in)	Minimum Restrained Length (L), feet Bends (degrees)				Reductions (sizes down)		
	11	22	45	90	1D	2D	DE
2	1	1	2	6	NA	NA	19
2.5	1	2	4	9	4	NA	23
3	2	3	5	11	8	10	30
4	2	4	9	20	14	20	45
6	3	6	13	29	30	40	63
8	4	8	15	38	33	55	83
10	5	9	19	45	31	56	100
12	5	10	21	53	54	58	118

Notes: 1D reduction denotes one size down (such as 4x3, 12x10)
2D reduction denotes two sized down (i.e. 4x2.5, 12x8)
DE is a dead end (for a cap, plug or a gate valve.)
More detailed tables are available upon request.

10. Ductile iron joint restraints shall be installed on all fittings and gate valves for all IPS-Size, ring joint PVC pipe. The joint restraint shall be capable of securing the PVC pipe directly to the lugs on the Leemco deep bell ductile iron fittings without the use of bolts, links and adapters. The joint restraint shall be capable of securing PVC pipe to PVC pipe and PVC pipe to ring joint gate valves without the use of threaded linkages.
    All ductile iron fittings shall be secured to full-length pipes and on all bends and tee branches, the next joint of the pipe shall be secured. At least two full lengths of pipe must be secured when attached to bends and tee branched 8" and larger, and at least three full lengths of pipe must be secured to dead end pipe. Pipe joints that occur in less than full-length when attached to a fitting shall also be secured.
11. All fittings shall be deep bell, manufactured specifically for IPS-Size pipe and made of Grade 65-45-12 ductile iron. Fittings 4" and larger shall have slanted bells to allow deflection of pipe in all planes. Fittings shall have four lugs at each push-on joint with ribbed and cupped gasket design, made from EDPM elastomer.

12. All quick coupling valves shall be fitted with Leemco Stabilizers. Quick coupling Stabilizers shall be manufactured in Grade 65-45-12 ductile iron; shall attach to the hex portion of the valve and be secured with a single bolt. Stabilizer shall have 12" span and be capable of resisting rotational and vertical motions. Stabilizers shall be LS-120 (3/4" and 1") and LS-150 (1 ½") as manufactured by Leemco, Inc., Colton, CA. Stabilizers made of plastic or fabricated from angle iron and U-bolts are not acceptable.

Part 3 - Execution

3.1 INSPECTION

A. Examine final grades and installation conditions. Do not start irrigation system work until unsatisfactory conditions are corrected and approved by Owner or Irrigation Consultant.

3.2 PREPARATION

A. Layout and stake the location of each pipe run and all sprinkler heads and sprinkler valves. Obtain Irrigation Consultant's acceptance of layout prior to excavating.
B. Strip sod for pipe trenches with a mechanical sod stripper uniformly 1" to 1-½" thick with clean-cut edges (for existing turf only).
C. Remove existing paving for sleeve installation. Saw cut existing paving to provide uniform straight transition at new to existing paving.
D. Place sleeves as indicated for installation of piping and control wire.

3.3 INSTALLATION

A. Excavating and backfilling:
   1. Excavation shall include all materials encountered, except materials that cannot be excavated by normal mechanical means.
   2. Excavate trenches of sufficient depth and width to permit proper handling and installation of pipe and fittings.
   3. If the pulling method is used, the pipe "plow" shall be vibratory type. Starting and finishing holes for pipe pulling shall not exceed a 1'-0" by 3'-0" opening.
   4. Excavate to depths required to provide 4" minimum depth of amended earth fill or sand bedding, free of all rock, and debris, for piping **on all sides and bottom of pipe** when rock or other unsuitable bearing material is encountered.
   5. Fill to match adjacent grade elevations with approved earth fill material. Place and compact fill in layers not greater that 8" depth.
      a. Provide approved earth fill or sand to a point 4" above the top of pipe - free of rock and debris
      b. Fill to within 6" of final grade with approved excavated or borrows fill materials free of lumps or rocks larger than 2" in any dimension.
      c. Provide clean topsoil fill free of rocks and debris for top 6" of fill.
   6. Except as indicated, install irrigation main lines with a minimum cover of 24" based on finished grades with a minimum depth of 30". Install irrigation lateral lines with a minimum cover of 18" based on finished grades with a minimum depth of 24". No sweeping of lateral lines.

7. Excavate trenches and install piping and fill during the same working day. Do not leave open trenches or partially filled trenches open overnight.
8. Replace stripped sod in sufficient time to allow for satisfactory sod recovery and growth. Water stripped and reinstalled sod until irrigation system is placed in operation (irrigation contractor to return turf to original condition or better). Existing turf conditions only.
9. Replace paving of same materials, using joints and patterns to match existing adjoining paving surfaces.
10. Backfill shall be compacted to 95% standard proctor density. Contractor will be responsible for the restoration of all settlement for period of (2) years from acceptance as well as all pipe and/or fitting failures.
11. **Vibratory pulling method to be employed on all greens, tees and fairways where 2" piping is shown on plans. Note: Contractor must shoot or lay wire – pulling shall not be permitted. Furthermore, no pulling when encountering rocky soils.**

B. Plastic pipe:
1. Install plastic pipe in accordance with manufacturer's installation instructions. Provide for thermal expansion and contraction.
2. Saw cut plastic pipe. Use a square-in-sawing vice, to ensure a square cut. Remove burrs and shavings at cut ends prior to installation.
3. Make plastic to plastic joints with solvent weld joints or slip seal joints. Use only solvent and purple cleaner recommended by the pipe manufacturer's instructions. Contractor shall make arrangements with pipe manufacturer for all necessary field assistance.
4. Make plastic to metal joints with Sch. 80 piping.
5. Make solvent weld joints in accordance with manufacturer's recommendations.
6. Allow joints to set at least 24 hours before pressure is applied to the system.
7. Maintain pipe interiors free of dirt and debris. Close open ends of pipe by acceptable methods when pipe installation is not in progress.
8. All gasketed PVC pipe shall be installed per manufacturer's recommendation using appropriate gasket lube.
9. Pulled pipe shall be solvent welded 36 hours in advance of pulling.
10. Contractor shall not drag PVC pipe before installation.
11. No substitution of smaller pipe, only larger sized pipe will be permitted.
12. All piping must be installed as per manufacturer recommendations including piping velocity rates.

C. Sprinklers, fittings, valves and accessories:
1. Install fittings, valves, sprinkler heads, swing joints and accessories in accordance with manufacturer's instructions.
    a. Provide concrete thrust blocks, at all change of directions, bends, reducers, plugs and opposite side of tees and any other unstable point of piping network (see details). 2,000 psi test on thrust block meeting all ASTM specifications C-33 and C-150 or C-175 standards – see section on fittings and tables.
2. Set sprinkler heads perpendicular to finished grades, except as otherwise indicated.
3. Obtain Irrigation Consultant's review and acceptance of height for proposed sprinkler heads and valves prior to installation.
4. Locate sprinkler heads to assure proper coverage of indicated areas. Do not exceed sprinkler head spacing distances indicated (as per manufacturer recommendations).

5. Install pop-up gear driven sprinklers on specified swing joint assemblies. (See Detail)
6. Install quick coupling valves on specified swing joint assemblies. (See Detail)
7. Install controllers as detailed.
    a. Pedestal mounted in locations shown on drawings.
    b. Waterproof wire conduit to provide a complete, waterproof, permanent and neat job. All 120 VAC wiring, including inside of control box – as per local codes.
    c. Ground controller in accordance with manufacturer's recommendations (10 OHMS or less) with Paige Electric plate configuration to get to 10 OHMS or less; measure by a meager device. It will be the responsibility of the contractor to prove such measurement before getting released from the said system installation. (See Plan & details).

D. Paige Electric Control wiring:
1. Install electric control cable in the piping trenches wherever possible. Place wire in trench adjacent to pipe. Install wire with slack to allow for thermal expansion and contraction. Expansion joints in wire may be provided at 200-foot intervals by making 5-6 turns of the wire around a piece of ½" pipe instead of slack. Where necessary to run wire in a separate trench, provide a minimum cover of 18" or as per local codes.
2. Provide sufficient slack at site connections at remote control valves in control boxes, and at all wire splices to allow raising the valve bonnet or splice to the surface without disconnecting the wires when repair is required.
3. Connect each remote control valve or sprinkler head to one address of a central controller except as otherwise indicated.
4. Connect remote control valves or sprinkler heads to a common ground wire system independent of all others.
5. Make secondary wire connections to sprinkler heads, remote control electric valves and splices of wire in the field; using PE listed burial splice connectors (i.e.: 3M DBY or 3M DBR), in accordance with manufacturer's recommendations.
6. Provide tight joints to prevent leakage of water and corrosion build-up on the joint.
7. Provide new sleeves for all locations where existing sleeves are not indicated. Install new sleeves prior to paving installation wherever possible.
8. Install pipe sleeves under existing concrete or asphalt surface by jacking, boring, or hydraulic driving of the sleeve. Remove and replace existing concrete and asphalt surfaces where cutting is necessary. Obtain Owner's permission before setting existing concrete and asphalt surfaces. Where piping is shown under paved areas that are adjacent to turf areas, install the piping in the turf areas.
9. One approved manufacturer shall be used for the entire project, no multiple manufacturers will be allowed **for all wire, pipe, cement and primer etc**.

E. Flushing, testing and adjustment:
1. After sprinkler piping and swing joints are installed and before sprinkler heads are installed, open control valves and flush out the system with full head of water. Swing joints should be extended above grade by 2-3 feet above grade by a section of pipe. This will help prevent contaminate piping during flushing.

2. Perform system testing upon completion of each section. Make necessary repairs and re-test repaired sections as required.
3. Adjust sprinklers after installation for proper and adequate distribution of the water over the coverage pattern. Adjust for the proper arc of coverage.
4. Test and demonstrate the controller by operating appropriate day, hour, and station selection features as required to automatically start and shut down irrigation cycles to accommodate plant requirements and weather conditions. Station to hold pressure for a minimum of 45 minutes at ± 3% of static set point.

I. Service:
1. When requested, return to the site during the subsequent fall season and winterize the system. Drain all water from the system and blow out the system with compressed air.
2. When requested, return to the site during the subsequent spring season and demonstrate to the Owner the proper procedures for the system start-up, operations, and maintenance (blow out climates only).

3.4 SPARE PARTS – N/A

3.5 DISPOSAL OF WASTE MATERIAL

A. Transport unsuitable excavated material, including rock or lava to designated disposal areas on Owner's property. Stockpile or spread as directed. Remove from site and legally dispose of trash and debris.
B. Maintain disposal routes clear, clean, and free of debris.

3.6 ACCEPTANCE

A. Test and demonstrate to the Irrigation Consultant and Owner the satisfactory operation of the system free of leaks.
B. Instruct the Owner's designated personnel in the operation of the system, including adjustment of sprinklers, controller (s) and central, valves and pump station(s).
C. Upon acceptance the Owner will assume operation of the system-See application for payment

3.7 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, soil, debris, and equipment. Repair damage resulting from irrigation system installation.

V. Electrical

Part 1 - General

1.1 APPLICABLE STANDARDS

A. All apparatus, materials and work, shall be in accordance with standards, practices and codes of the electrical industry. Particular attention is directed to requirements of ANSI/NFPA 70 and Underwriters Laboratories, Inc. as suitable for purposes specified and shown.

B. The completed irrigation installation shall conform to all local and special laws, codes or ordinances of all Federal, State and municipal authorities with due jurisdiction.

1.2 PROJECT CONDITIONS

A. Locations of all controllers, heads and other elements of the system are to be approved by Owner or Owner's Representative before wiring is installed.
B. Conductor sizes are based on copper.
C. Wire and cable routing shown on the drawings are approximate. Route wire as required meeting project conditions-See plan
D. Take precautions to avoid damage to existing site elements and features, including wiring and piping for existing underground irrigation system. Promptly repair damage to such features, cost at Contractor's expense.

Part 2 - Products

2.1 PRIMARY CABLE - See plan

A. All power cables are single conductor or tray cable (or approved equal); UL listed for direct burial, and rated at 600 volts. The cable shall include three conductors, which are to be colored per wire industry standard or numbered as 1, 2, and 3. The size of the "hot" and "common" conductors are to be as shown on the irrigation plans, and the size of the "equipment ground" conductor as required by the National Electrical Code, or larger. The inner copper conductors are to be covered with high dielectric PVC and Nylon. The outer jacket will be black PVC and is to be sunlight resistant. (Paige Electric Co., (or approved equal) LP specification number P7266D for 10 AWG and smaller and specification number P7267D for 8 AWG and larger.)
B. Conduit: As required by code all branch circuit wires, for 120 volts and higher, shall be installed in electrical conduit. The wires shall be type THWN and sized according to the irrigation system plans. Paige Electric Co., LP specification number P7316. Installation shall meet all local codes and regulations as well as NEC requirements for burial conduit piping. The total cross-sectional area of the wires sleeved through the electrical conduit shall be no more than 40% of the internal cross-sectional area of the conduit.

2.2 SECONDARY CABLE

A. Wires connecting the remote control valves to the irrigation controller are single conductors, type PE. Its construction incorporates a solid copper conductor and polyethylene (PE) insulation with a minimum thickness of 0.045 inches. The wires shall be UL listed for direct burial in irrigation systems and be rated at a minimum of 30 VAC. Wire sizes and colors are defined in the irrigation plans and other specifications. (Paige Electric Co., (or approved equal) LP specification number P7079D.)

2.3 EARTH GROUNDING

A. It is the responsibility of the installer to connect all electronic equipment for which they are responsible to earth ground in accordance with Article 250 of the National

Electrical Code (NEC). Grounding components will include the items described in the following paragraphs, at a minimum.

Use grounding electrodes that are UL listed or manufactured to meet the minimum requirements of Article 250 of the NEC. At the very minimum, the grounding circuit will include a copper clad steel ground rod, a solid copper ground plate and 100 pounds of PowerSet® earth contact material, as defined. See detail.

Ground rods are to have a minimum diameter of 5/8" and a minimum length of 10 feet. These are to be driven into the ground in a vertical position or an oblique angle not to exceed 45 degrees at a location 10 feet from the electronic equipment, the ground plate, or the wires and cables connected to said equipment. See detail. The rod is to be stamped with the UL logo (Paige Electric part number 182007.) A 6 AWG solid bare copper wire (about 12 feet long) shall be connected to the ground rod by the installer using a Cadweld GR1161G "One-Shot" welding kit (Paige Electric part number 1820037.) This wire shall be connected to the electronic equipment ground lug. See detail.

The copper grounding plate assemblies (Paige Electric part number 182199L) will have minimum dimensions of 4" x 96" x 0.0625" (satellites). A 25-foot continuous length (no splices allowed unless using exothermic welding process) of 6 AWG solid bare copper wire is to be attached to the plate by the manufacturer using an approved welding process. This wire is to be connected to the electronic equipment ground lug as shown in the detail of page 1. The ground plate is to be installed to a minimum depth of 30", or below the frost line if it is lower than 30", at a location 8 feet from the electronic equipment and underground wires and cables. Two 50-pound bags of PowerSet® with a neutral PH value (Paige Electric part number 1820058) earth contact material must be spread so that it surrounds the copper plate evenly along its length within a 6" wide trench. Salts, fertilizers, bentonite clay, cement, coke, carbon, and other chemicals are not to be used to improve soil conductivity because these materials are corrosive and will cause the copper electrodes to erode and become less effective with time.
Install all grounding circuit components in straight lines. When necessary to make bends, do not make sharp turns. To prevent the electrode-discharged energy from re-entering the underground wires and cables, all electrodes shall be installed away from said wires and cables. The spacing between any two electrodes shall be as shown in the detail of page 1, so that they don't compete for the same soil.
The earth-to-ground resistance of this circuit is to be measured using a Megger® or other similar instrument, and the reading is to be no more than 10 ohms. If the resistance is more than 10 ohms, additional ground plates and PowerSet® with a neutral PH value are to be installed in the direction of an irrigated area at a distance of 10', 12', 14', etc. It is required that the soil surrounding copper electrodes be kept at a minimum moisture level of 15% at all times by dedicating an irrigation station at each controller location. The irrigated area should include a circle with a 10-foot radius around the ground rod and a rectangle measuring 1-foot x 24-feet around the plate.

All underground circuit connections are to be made using an exothermic welding process by utilizing products such as the Cadweld "One-Shot" kits. Solder shall not be allowed to make connections. In order to ensure proper ignition of the "One-Shot", the Cadweld T-320 igniter must be utilized (Paige Electric part number 1820040.) The 6 AWG bare copper wires are to be installed in as straight a line as possible, and if it is necessary to make a turn or a bend it shall be done in a

sweeping curve with a minimum radius of 8" and a minimum included angle of 90°. Mechanical clamps shall be permitted temporarily during the resistance test process but are to be replaced with Cadweld "One-Shot" kits immediately thereafter.

2.4 BONDING

A. Said grounding circuit is referred-to as "supplementary grounding" in the NEC. And for safety reasons, the NEC required that all supplementary grounds be "bonded" to each other and to the service entrance ground (power source) as shown. This is also "recommended practice" of IEEE Standard 1100-1999. Note that this is in addition to the equipment ground, which is commonly referred to as "the green wire." The power wires (black, white and green for 120 VAC and black, red and green for 240 VAC) must always be kept together in a trench/conduit/tray/etc. The bonding conductors are to be 6 AWG solid bare copper unless the system power conductors are larger than 1/0 AWG, in which case they are to be 4 AWG solid bare copper. All splices to the bonding conductors shall be made using a Cadweld "One-Shot" kit. See details. (Paige Electric part number 1820074)

2.5 SHIELDING – N/A

A. The bonding conductors are to be installed in such a way so that they act as shielding conductors. This becomes a network of solid bare copper wire over all the main bundles of other wires and cables. See details. The bare copper wire is to be installed as close to the surface as possible yet being sufficiently below the ground level as to prevent damage from maintenance equipment such as aerators. And it must be place above all other valve/power/communication wires and cables, per detail, and installed in all trenches as shown on the electrical plan drawings. It is not necessary to install this conductor over short wire runs (less than 150 feet) away from the main wire bundles. The conductor is laid in as straight a line as possible, and when necessary to make bends, do so in a sweeping motion using the detail as a guideline.

Part 3 - Execution

3.1 GENERAL

A. Installation of wiring shall be in accordance with Section IV Irrigation System and in accordance to irrigation system manufacturer's instructions.
B. Any wire or cable that is stressed or damaged in any way shall be replaced at the Contractor's expense.
C. Make splices with approved connector assembly as specified in Section IV Irrigation System.
D. Inspect wire and cable for physical damage and proper connection. Verify continuity of each control circuit.
E. Wire and Cable Installation: Wire and cable burial depth is dictated by the National Electrical Code®. Temperature changes cause wires and cables to expand and contract as much as 1% of the length. And high voltage power lines create large electro-magnetic fields that cause interference and corrupt signals in communication lines. It is therefore necessary to take certain precautions when installing these products.

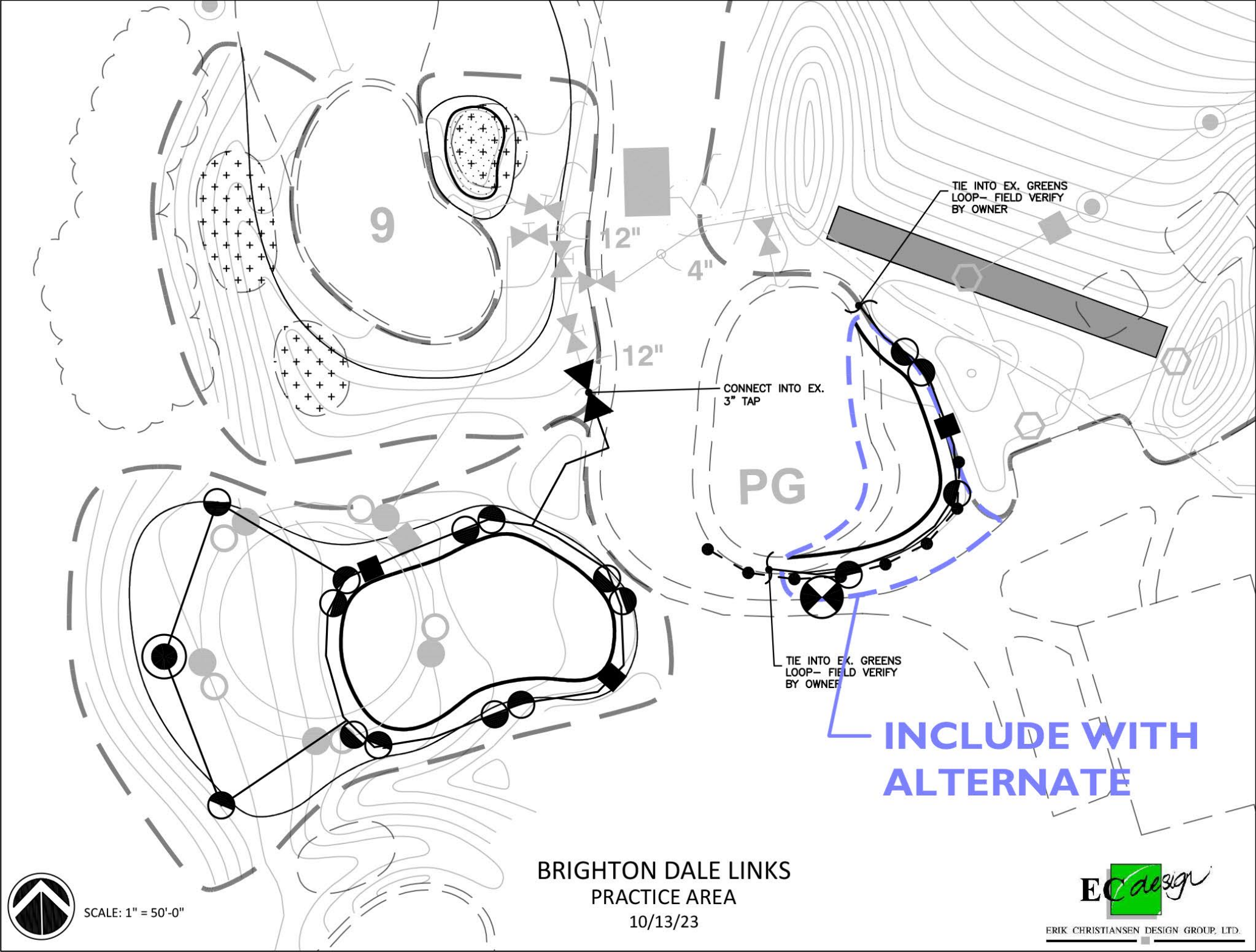
The contractor shall install all wires and cables carrying up to 30 volts at a minimum burial depth of 6". If mechanical equipment, such as aerifiers and shovels, are expected to disturb the area, then the wires and cables shall be installed at a 12" depth. For wires and cables carrying more than 30 volts and less than 600 volts, the minimum burial depth shall be 24". When installing wires and cables in a trench, they must be "snaked" so that some slack is created. At points along the trench where there are sharp bends, a loop of 12" to 24" shall be created to allow for shrinkage. When communication cables are in the same trench as power wires, there shall be a minimum separation between them of 12"

F. Wire and Cable Splices:

All electrical connections shall incorporate:

1. A solid mechanical connection of the copper conductors.
2. Electrical insulation of the mechanical connection.
1. A means to waterproof the insulated connection.
2. "Strain-relief" to prevent the connection from coming apart when wires/cables are pulled-upon.

End of Section



SCALE: 1" = 50'-0"

BRIGHTON DALE LINKS

PRACTICE AREA

10/13/23

ERIK CHRISTIANSEN DESIGN GROUP, LTD.