

TECHNICAL REPORT • FEBRUARY 2025

# Black Oak Ranch Water Conservation Project Construction Specifications

PREPARED FOR

Eel River Recovery Project  
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# **1 GENERAL**

## **1.1 Definitions**

Stillwater Sciences presumes that for the purposes of this document, the following definitions are adopted globally, unless indicated otherwise:

**“Contract Document(s)”**

All relevant documents and agreements that define the responsibility, scope, and tasks of each party in the contract, as they relate to the planning/execution/construction/installation of the Design Documents, in accordance with, and to the satisfaction of, Stillwater Sciences, SRF and Owner.

**“Design Document(s)”**

All design outputs and documents relevant to the planning, permitting, and execution of this flow enhancement project. These documents describe the design, compliant materials, and installation procedures. These documents include but are not limited to the specifications herein, design plans associated with the bid procurement and any future revisions of those design plans, and final permit documents.

**“Stillwater Sciences”**

Qualified, duly appointed, and delegated person(s) speaking/acting on behalf of Stillwater Sciences’ Project Manager(s), Designer(s), Engineer(s), Biologist(s), or Botanist(s).

**“SRF”**

Salmonid Restoration Federation (SRF) is the project administrator who has received grant funding from the California Wildlife Conservation Board and will be entering into contractual agreement(s) with the Contractor(s).

**“Contractor(s)”:**

Duly awarded/contracted construction professional, fully qualified and certificated to complete work and scope in a manner compliant with all governing building and occupational codes (CBC/OSHA) and material standards (ATSM).

**“Owner(s)”**

Qualified, duly appointed, and delegated person(s) speaking/acting on behalf of the property owner, Black Oak Ranch LLC.

## **1.2 General**

The intent of the specifications and guidance herein is to provide construction, installation, and material specifications as they are relevant to the Contractor completing the project elements represented within the associated design plan set and related documents (Design Documents) developed and provided by Stillwater Sciences; these specifications do not apply to materials, work, or guidance beyond those included in the issued current and approved Design Documents.

Due to the permit-dependence inherent in the design elements provided by Stillwater Sciences for this project, any proposed or desired changed to the proposed elements and materials as shown and approved by the relevant jurisdictional and Agency/Entities can inherently carry the risk of inadvertent potential permit violation.

The specifications herein correspond to the materials, sections, and details represented in the Design Documents; therefore, adherence to both the material and installation guidance within the Design Documents and these specifications are presumed as mandate unless express written permission is provided by Stillwater Sciences for variations.

Should the Contractor executing the work detailed within these Design Documents desire or propose a change to the configuration contained therein, the Contractor shall provide a documented “Request for Information” (RFI) or similar standard approach for tracking and communicating proposed design changes to Stillwater Sciences and inherently provide Stillwater Sciences with an effective means for ongoing design coordination with the Contractor implementing the Design Documents.

This process at a minimum shall include the Contactor preparing and submitting a written and graphic representation (“red-line markup”) of the proposed modification along with any associated material specifications, cutsheets, and Safety Data Sheets (SDS) to Stillwater Sciences for review and approval prior to any change being approved or executed. The above RFI/redline item shall clearly disclose the Contractor’s proposed procedures and methods of installation/operation, including identifying any new/special equipment or materials required to execute the proposed/desired design modification.

The Contractor shall allow at least five (5) working days for review and response to the RFI/redline item; regardless of elapsed duration, the proposed change shall not be considered “approved” until express written approval and concurrence is received from Stillwater Sciences. Any work, materials, or effort spent by the Contractor to facilitate the above process, or any effort spent prior to “approval” of an RFI/redline being received from Stillwater Sciences is solely the responsibility of the Contractor.

The Contractor shall make every effort to minimize his work area and keep the construction area clean and free of all excess trash, debris, pollutants, and dust at all times. The Contractor shall take all reasonable precautions to restrict their operations to the least area of work possible and shall not disturb private property beyond the areas of work and approved via the below conditions.

The Contractor shall be cognizant if the project involves work within or adjacent to a:

- public or private parcels,
- easements,
- rights-of-way, and/or
- agency, municipality, utility, or other relevant jurisdictional regions and bounds.

Access to the project site shall be consistent with the Design Documents utilizing existing roadways. The Contractor shall not utilize additional access routes without proper approvals. Should additional access routes be desired by the Contractor, they should obtain and submit written approval from the Owner and SRF.

Unless otherwise indicated by the Design Documents, all trees are to be protected.

It is presumed by Stillwater Sciences that the contractor cannot proceed without a written “notice to proceed” issued by SRF. Contractor shall notify the SRF a minimum of one week prior to commencement of work and must work within the construction schedule outlined in the bid package.

The Contractor shall always keep driveway access open to adjacent neighbors. Before road closure, a minimum of (7) seven calendar days advanced notice is required. Signage and barricades are the responsibility of the Contractor. The closure area shall be always barricaded in order to protect the public from any open trenches.

It is presumed by Stillwater Sciences that the Contractor shall operate and execute their work during industry typical and standard “normal” hours for the jobsite and shall not be earlier than 7:00 a.m. or later than 5:00 p.m. weekdays. Should these typically assumed hours of operation conflict with relevant agency or jurisdictional permit conditions or other restrictions on work execution and timing (noise, air quality, light, nesting seasons, etc.), the relevant permit condition takes precedence, unless specific express exemption is provided by the entity issuing the permit to the Contractor.

It is presumed by Stillwater Sciences that should the Contractor need to stage equipment and materials along jurisdictional regions, there shall be unobstructed access for Owners at all times. The Contractor shall provide any additional equipment or material staging areas at their own expense and effort. Any damage or use of private property, non-city or county-maintained road, or facility is the responsibility of the Contractor. The Contractor shall use suitable sized equipment to prevent such damage. Any damage or destruction to existing infrastructure, property or associated facilities and components, beyond what is detailed in the Design Documents, inadvertent or otherwise, shall be the responsibility of the Contractor.

Proposed materials within these Design Documents and Specifications presume procurement of indicated materials from standard quarries and vendors in compliance with their respective governing certifying bodies and associated regulatory oversight of their respective industries. For example, Stillwater Sciences presumes that use of a “Caltrans” material specification herein will mandate the source of the material chosen by the Contractor to be in compliance with and currently certified by “Caltrans”. Should Stillwater Sciences request verification of the material’s source (e.g. vendor/location), specifications (e.g. gradation), or quality (e.g. ASTM/ANSI) of materials obtained by the Contractor (or subcontractor, or delegate) that is intended to be installed to satisfy these Design Document’s, the requested information shall be provided, reviewed and concurred by Stillwater Sciences prior to placement or delivery; materials procured or placed that do not comply with the above, are solely done at the effort and expense of the Contractor.

All earthen material, deleterious surficial grubbing of vegetation, debris, soil, silt, bark, rubbish, creosote-treated wood, raw cement/concrete or washings thereof, unmixed components of epoxy resins/adhesives, asphalt, paint or other coating material, oil or other petroleum products, or any

other substances which could be hazardous to aquatic life, resulting from project-related activities, shall be prevented from contaminating the soil and/or entering the public waters.

Any of these materials, placed within or where they may enter a stream or lake, by any party working under contract shall be removed immediately. During project activities, all trash that may potentially attract wildlife will be properly contained, removed from the work site, and/or disposed of daily.

Dimensions noted on the Design Plans take precedent over scale.

Stillwater Sciences presumes that all California Occupational Safety and Health Administration (OSHA) Standards of the U.S. Department of Labor shall be followed as mandate.

### 1.3 Order of Work/Progress Schedule

Construction work for the site shall be coordinated with any work by utility entities performing utility relocations to avoid conflicts. Monetary reimbursement for any right of way delays regarding work by utility entities shall not be allowed.

The Contractor shall prepare and submit a work plan and progress schedule in a form provided by or acceptable to Stillwater Sciences. The above items shall clearly disclose the Contractor's proposed procedures and methods of operation, including identifying any special equipment intended for use on the project. The Contractor shall allow 5 working days for review and approval of this item by Stillwater Sciences. The Progress Schedule will be reviewed weekly for accuracy. Any modifications to the Progress Schedule shall be submitted to Stillwater Sciences in writing. Modifications to the Progress Schedule will not constitute approval for a work schedule extension.

No work may begin under the contract until Stillwater Sciences has approved the Progress Schedule. Time required for review and approval of these items shall not constitute a basis for time extension.

As/if provided within the approved contractual scoping documents, Stillwater Sciences may, upon request, provide estimates and guidance into the potential for permit timing, sequencing, scheduling and general coordination pursuant to environmental and regulatory permits; this undertaking does not imply or guarantee any permit obtention or associated coordination with regulatory jurisdictional bodies.

Unless detailed otherwise within Stillwater Sciences contractual scoping documents, the Contractor is responsible for ensuring that all permits are in place prior to staging of materials or commencement of work. Any potential delays to installation or execution required to maintain compliance with governing permits is not the responsibility of Stillwater Sciences.

Full compensation for complying with these provisions shall be considered as included in the contract price paid for various items.

Once a contract has been formed, work on the project may commence, with the following conditions:

- All work is dependent on favorable weather conditions.
- Contractors shall coordinate the commencement of work with SRF.
- No work shall begin until authorized by SRF.

There are **schedule limitations** for work at the Camp facility which includes portions of Scope A (Streeter diversion) and Scope C (plumbing and electrical associated with Streeter diversion, camp rainwater catchment, and associated plumbing and electrical in the vicinity). The work in this area must be completed within the following times:

- August 1 to August 25, 2025 .
- Monday through Thursday only during the period of September 4 to October 1, 2025
- Anytime after October 1, 2025 (weather dependent)

Below is a schedule for each of the four project scopes. Note that the schedule limitations described above must be adhered to as applicable:

- Scope A, Pond and Diversion Infrastructure: All tasks must be completed by October 15, 2025.
- Scope B, Rainwater Catchment Tanks: All tasks must be completed by December 1, 2025.
- Scope C, Plumbing and Electrical Infrastructure and System Components: All trenching shall be completed by October 15, 2025. All other Scope C project tasks shall be completed by Dec 31, 2025.
- Scope D, Forest Clearing for 3-acre Conversion: All work must be completed by June 15, 2025.

#### **1.4 Water Quality Management and Compliance**

Contractor shall keep itself and all subcontractors, staff, and employees fully informed of and in compliance with all local, state and federal laws, rules and regulations that may impact, or be implicated by the performance of the Work including, without limitation, all applicable provisions of the Federal Water Pollution Control Act (33 U.S.C. §§ 1300); the California Porter-Cologne Water Quality Control Act (Cal Water Code §§ 13000-14950); local ordinances regulating discharges of storm water; and any and all regulations, policies, or permits issued pursuant to any such authority regulating the discharge of pollutants, as that term is used in the Porter-Cologne Water Quality Control Act, to any ground or surface water in the State.

Contractor shall also comply with the lawful requirements of any applicable municipality, drainage District, or local agency regarding discharges of storm water to separate storm drain systems or other watercourses under their jurisdiction, including applicable requirements in municipal storm water management programs. Storm, surface, nuisance, or other waters may be encountered at various times during construction of the project and the Contractor shall assume any and all risks and liabilities arising therefrom.

Contractor shall comply with all conditions of the most recent iteration of the National Pollutant Discharge Elimination System General Permit for Storm Water Discharges Associated with Construction Activity (Construction General Permit), issued by the California State Water Resources Control Board. SRF shall file the Notice of Intent for the Storm Water Pollution Prevention Plan (SWPPP) and procure coverage under the Construction General Permit. Contractor shall be solely responsible for implementing the requirements of the SWPPP and Construction General Permit.

Monitoring and reporting will be the responsibility of SRF supported by SWPPP developers Village Ecosystems and Teri Jo Barber. If Contractors do not meet the construction deadlines for the Work Schedule, Contractors are responsible for any additional costs for SWPPP implementation including but not limited to monitoring, reporting, and rainfall action plans. The Construction General Permit requires the SWPPP to be a “living document” that changes as necessary to meet the conditions and requirements of the job site as it progresses through difference phases of construction and is subject to different weather conditions. The Contractors implementing the SWPPP measures must be in direct communication with SWPPP developer (Village Ecosystems and Teri Jo Barber) to prepare SWPPP updates in response to changing conditions over the course of project implementation.

The current Design Documents provide the material requirement for commonly used BMPs. However, it is anticipated that the SWPPP requirements will be more stringent than the standard

BMPs described in the current Design Documents and therefore the SWPPP requirements should supersede the current Design Documents as applicable. If conflicts arise between the SWPPP and Design Documents, the Contractors shall work with SRF and Stillwater Sciences to find a mutually agreed upon solution that meets all permit requirements.

## **1.5 Measurement and Payment**

### **1.5.1 General**

The price bid shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all work involved in completing the scope shown in the Design Documents, completed in place, as specified herein, and as directed by Stillwater Sciences.

Line-item costs are presumed by Stillwater Sciences to include, but not be exclusively limited to, the following:

- demolition and removal of deleterious materials and debris as needed to complete the scope shown in the Design Documents;
- grading, excavating, trenching, backfilling, and handling;
- compacting to the specified relative compaction levels;
- furnishing water necessary to moisten, place or otherwise aid in backfilling and compaction operations;
- stockpiling and moving excavated material regardless of number of times;
- grubbing and clearing and disposal of waste and demolition;
- rough and finish grading;
- off-hauling of surplus material;
- placement of rock and gravels;
- installation, testing, and operation of all plumbing, electrical, and associated support and ancillary infrastructure;
- installation and completion of all habitat features contained within the Design Documents, such as large wood habitat features;
- materials obtained satisfy the specifications herein;
- installation and functional checks on all water tank, treatment, and pumping systems;
- necessary pressure testing and other system checks to verify system function after installation, and any adjustments or rework necessary to restore/improve function;
- placement and incorporation of vegetative and erosion control elements
- working compliance with all County, State, and Federal OSHA and Cal-OSHA requirements for preserving the health and safety of personnel, the public, and the environment; and
- awareness and adherence to all permits, and conditions therein, associated with the completion of the work shown in the Design Documents.

### **1.5.2 Volumetric measurements**

Volumetric earthwork and import quantities have been measured and estimated using the grading capabilities of AutoCAD Civil 3D for the configuration shown on the Design Plans. Earthwork quantities are estimates and adjustments may be made in the field by Stillwater Sciences. The cost of excavation and backfill below finish grade elevations for any features are not included in the total earthwork volume estimates presented in the Design Documents and shall be considered included in the individual cost of the bid items.

### **1.5.3 Weight measurement**

The weight of all rock imported to the site shall be measured and documented by the volume and weight of material entering the site for each respective type of rock or gravel material. To ensure that the Contractor is utilizing the appropriate tonnage and type of rock for each structure, each truckload of rock arriving on-site shall be accompanied by a certified weight ticket furnished by a licensed weigh master. The Contractor shall supply the Stillwater Sciences weekly with copies of each certified weight ticket for Stillwater Science's records.

### **1.5.4 Payment**

Contractor shall be paid for each bid item in conformance with the bid documents. No separate payments shall be made for any ancillary project components because these are included in the bid item prices as described above in Section 1.4.1.

Contractors shall provide a rate sheet and standard materials markup rate in their bid. If there are modifications to the project design that diverge substantially from the bid documents and Design Documents, the Contractor shall work with Stillwater Sciences to develop a mutually agreed upon plan to address the change and shall be paid on a time and materials basis based on the rate sheet.

The funding source for this project is the California Wildlife Conservation Board's Streamflow Enhancement Program. Since this project is grant funded, Contractors will not be paid until invoices are submitted and received so project reimbursements may take up to 90 days. Additionally, there is 10% retention that will be passed down to the Contractors. SRF will bill monthly during construction so Contractors can be paid within the 90 day terms. After construction, SRF will apply for the retention request, and once received Contractors will have the 10% retention that was withheld from payments, reimbursed. This will likely occur in January 2026.

## **2 EXISTING FACILITIES**

### **2.1 General**

It is not the intent of the Design Documents herein to show the exact location of existing, relocated, or temporary proposed utility systems not expressly included within Stillwater Science's contractual scope and associated Design Documents; Stillwater Sciences assumes no responsibility therein for the plan view and/or schematic representation of existing, relocated, or temporary proposed utility systems beyond those expressly included within Stillwater Science's contractual scope.

Indication of relevant active and/or abandoned utility systems and buried commodities on the Design Documents herein implies no guarantee; the Contractor shall be solely responsible for verifying the actual physical location and depth in the field for existing utilities within the project extent. The Contractor shall notify the appropriate Underground Service Alert (811) for their location at least forty-eight (48) hours prior to planned excavation commencing. Excavations started prior to ground-marking and proper utility identification are done so at the sole risk of the Contractor.

It is the presumption of Stillwater Sciences, that excavations in the vicinity of underground utility mains and/or critical services that the Contractor shall, as necessary, perform cautious exploratory excavations (e.g. "potholing") with hand tools or "air spade" to verify/determine the exact depth and location of utilities present.

Extreme care shall be exercised to avoid damage to any existing utility system or component, and in the event of damage it will be the Contractor's responsibility to have repairs made to existing facilities at their expense. Where existing utilities require temporary or permanent relocation to accommodate proposed work, the Contractor will work with the utilities to provide a minimal interruption to local service.

If the Contractor requires overhead power lines to be de-energized to facilitate work, the Contractor shall notify and coordinate the desired window of de-energization.

Existing utility poles, communication, and telephone lines shall be protected in place during construction. If Contractor requires utilities to support the pole or lines during construction, Contractor shall coordinate with relevant utility prior to construction activities.

To avoid conflicts, construction work for the site shall be coordinated with any anticipated relocation work undertaken by utilities with systems near or in the project site to the fullest feasible extent, especially those that require "crossing" a channel, creek, river, wetland, related body of water, or similar environmental or jurisdictional extent relevant to the Design Documents herein.

The Contractor shall undertake the necessary coordination with relevant municipalities, utilities, and jurisdictional agencies to maintain configuration control for systems/bounds affected by execution of the Design Documents herein as they relate to existing (pre-project) and proposed (post-project) conditions.

Full compensation for complying with the above provisions shall be considered as included in the contract price for the various bid items and no separate payment will be made.

### **3 CONSTRUCTION STAKING**

#### **3.1 General**

Stillwater Sciences shall provide construction staking for the project. The Contractor shall notify the Engineer at least 14 working days in advance of when construction stakes will be required, and preferably 30 days prior. Stillwater Sciences will provide the contractor with survey control coordinates and geospatial reference datum used for the Project.

Any undue destruction of stakes by the Contractor shall constitute cause to hold the Contractor liable for the cost of re-staking and said cost shall be deducted from any monies due the Contractor.

Full compensation for complying with the above provisions shall be considered as included in the contract price for the various bid items and no separate payment will be made.

## **4 SIGNS AND TRAFFIC CONTROL**

### **4.1 General**

All signs and other warning devices (including construction and warning signs placed beyond the limit of work), shall be provided by the Contractor, and shall remain their property after the completion of the contract.

The Contractor shall refer to the current California Manual of Temporary Traffic Controls for Construction and Maintenance Work Zones and the Uniform Signs Chart issued by the California Department of Transportation, and shall furnish, erect, maintain, and remove all necessary signs and devices during the length of this contract.

Work shall be accomplished in such a manner as to provide access to all intersecting streets and adjacent properties whenever possible. If during the course of the work it is necessary to restrict access to certain driveways for an extended period of time, the Contractor shall notify the affected residences and Stillwater Sciences in writing, at least 48 hours in advance.

If necessary, the Contractor shall post temporary ROAD CLOSURE signs within the private road network within the project vicinity. Road closure signs shall read as follows with date of anticipated closure. Signs shall be placed a minimum of 72 hours in advance of construction activities. Where existing road signs are in conflict with the proposed work, the Contractor shall relocate such signs to temporary or permanent locations as directed by the Engineer or Geologist. It shall be the responsibility of the Contractor to maintain signs and barricades overnight and on weekends.

Open trenches shall be adequately barricaded to protect the public at all times. Road closure barricades shall be equipped with flashing beacons that are visible at night. The Contractor shall be responsible for maintaining all barricades and flashing beacons for the duration of the project. Any non-functioning beacons shall be repaired by the end of the work shift. In addition, Type II barriers shall be placed across the roadway to ensure observance of road closure during all hours for pedestrian and vehicular safety at all times. K-rail barriers shall be placed on road at the boundaries of excavation to prevent vehicles from approaching or falling into excavation in the roadway.

It is the responsibility of the Contractor to arrange for the towing and removal of any vehicles which interfere with the work operations. Full compensation for the removal of the vehicles shall be considered as included in the price paid for the various items of work and no additional compensation will be allowed.

At the end of each day's work, and at other times when construction operations are suspended, all equipment and other obstructions shall be removed from that portion of the roadway open for use by local residents.

Where existing road signs are in conflict with the proposed work, the Contractor shall cover existing signs or relocate such signs to temporary locations as directed by Stillwater Sciences.

The Contractor shall examine the entire project site at the end of each day and verify that all necessary warning signs are in place and have effective night reflective visibility.

Full compensation for complying with the above provisions shall be considered as included in the contract price for the various bid items and no separate payment will be made.

## 5 CLEARING AND GRUBBING

### 5.1 General

Stillwater Sciences presumes, at a minimum, the following conditions and specifications are satisfied and applied during the planning and execution of activities within the Design Documents.

An underground marking service such as “811”, and/or local equivalent, is utilized in advance of any ground disturbing activities to adequately and sufficiently indicate the locations and depths of relevant utility system anticipated to be active within the project extents shown on the Design Documents.

Clearing and grubbing activities shall be limited to the minimum horizontal extent and shallowest depths feasible to remove deleterious and foreign materials from the regions shown in the Design Documents (including surficial grading, trenching, and regions receiving imported fill prism). Within the project limits and access points that are anticipated to be affected by the project, identification of desirable or protected existing vegetation (herbaceous, shrub, and/or tree) shall be completed prior to any disturbance.

Deleterious and foreign materials removed by clearing and grubbing shall include, but not be limited to the following:

- Near-surface layers of topsoil, dirt, and stone (earthen materials) containing vegetative and deleterious matter to a minimum depth of 6-inches below the existing top of earth, and deeper as needed, to remove any observable additional quantities of deleterious or foreign materials from the regions indicated in the Design Documents (grading, fill, and trenching).
- Removal of foreign materials encountered during excavation includes: concrete and associated reinforcement; paving or other “hardscape” type cover; cuttings and rubble produced during demolition; wooden, metal, or other miscellaneous and “unnatural” debris, abandoned piping of existing encountered materials; cables, conductors and associated conduits; all plastic containing materials (polypropylene, HDPE, etc.); fencing (metal, plastic, and/or wood), and any other material identified by Stillwater Sciences and or at the discretion of the permit issuing agency.
- Should the Contractor encounter an unknown or unexpected utility within the region of work indicated on the Design Documents, they shall stabilize and stop work in that area until the system is identified and a suitable plan can be developed between the Owner(s) and the utility entity. The Contractor may remove only portions of abandoned utilities that are in direct conflict with the excavation extents indicated on the Design Documents. Prior to such removal, the Contractor shall verify with the relevant utility or entity that the conflicting system/pipe/cable is indeed abandoned and nonfunctional.
- Trees are not to be removed unless stated specifically in the Design Documents.
- Requirements listed in the three acre conversion permit and associated documents shall guide tree removal and cleanup for the work associated with clearing of the water tank sites. Within this area, woody material not suitable for other purposes may be piled and burned in compliance with all relevant permit requirements.
- Existing trees throughout the project site that are *not* marked for removal, shall always be protected from equipment. Other trees that are *not* marked for removal, may require trimming/limbing to accommodate equipment movement/access; tree trimming or limbing will be limited to the minimum amount necessary, or under/at the supervision/discretion of, Stillwater Sciences or the Agency issuing the permit.

- The Contractor shall protect the root systems for identified existing trees within the proximity of the construction and access routes that are anticipated on the Design Documents.
- Remove only the necessary roots/materials that directly interfere or conflict with the execution of the installation work described in the Design Documents. Any roots that require removal or severing that are larger in diameter than a typical human's forearm, shall consult with Stillwater Sciences prior to removal.
- Access points shall be designated in the field prior to construction. Additional access points shall not be used unless prior coordination and concurrence with Stillwater Sciences has occurred.
- The contractor shall not cross any property boundaries within the express written approval of the Owners.
- Remove any debris, existing signs, or facilities that are in conflict with the proposed work, and all other items conflicting with the work as necessary to accommodate construction operations, as shown on the Design Documents or as directed by Stillwater Sciences or the Agency issuing the permit.
- All clearing and grubbing spoils, miscellaneous removed materials, and associated deleterious and foreign materials, unless otherwise indicated on the Design Documents and specified herein, shall become the property of the Contractor and disposed of outside the road right-of-way at a legal dumpsite.
- Clean topsoil and/or sod material may be re/used on the outside of the pond berm as directed by Stillwater Sciences.

## **6 EARTHWORK**

### **6.1 General**

This section includes excavation, site preparation and grading, fill placement, compaction, rough grading, and finish grading to the lines and grades shown on the Design Documents and as directed by Stillwater Sciences.

Earthwork shall consist of performing all operations required to excavate and backfill all the materials specified to achieve the configuration shown, or stability required, in the Design Documents, regardless of the character and subsurface conditions encountered. Earthwork shall also include all moving and compacting of earthen materials, and the creation and removal of any necessary access ramps.

Earthwork includes all forms of excavation and fill placement for the project as well as trenching and backfill associated with plumbing, electrical, riprap placement and any other application in a manner consistent with those shown in the Design Documents. The Design Documents provide the desired geometry and intended grading configuration; should conditions arise that preclude the establishment of that geometry, or otherwise require a modification to grade, topography, or “surface” configuration shown within the Design Documents, those changes cannot occur without the coordination, concurrence, and express consent of Stillwater Sciences. Any approved adjustments to the configuration shown in the Design Documents shall be directed in the field, or otherwise designed and implemented, by Stillwater Sciences.

Cross sections are shown on the Design Plans to illustrate the intent, but grading may also be adjusted in the field as directed by Stillwater Sciences.

### **6.2 Backfill materials**

Proposed materials (including backfill) within these Design Documents and Specifications presume procurement of indicated materials from standard quarries, topsoil vendors, and material batch plants in compliance with their respective governing certifying bodies and associated regulatory oversight of their respective industries. The Project does not propose any structural backfill material import for the site.

For example, Stillwater Sciences presumes that use of a “Caltrans” material specification herein will mandate the source of the material chosen by the Contractor to be in compliance with and currently certified by “Caltrans”. Should Stillwater Sciences request verification of the material’s source (e.g. vendor/location), specifications (e.g. gradation), or quality (e.g. ASTM/ANSI) of materials obtained by the Contractor (or subcontractor, or delegate) that intended to be installed to satisfy these Design Document’s, the requested information shall be provided, reviewed and concurred by Stillwater Sciences prior to placement or delivery; materials procured or placed that do not comply with the above, are solely done at the effort and expense of the Contractor.

### 6.2.1 Structural Backfill Material

No structural backfill import is proposed for the Project. Structural backfill material is to be sourced from recompacted, reused spoils from excavations conducted on site. This material is to be used for the construction of berms and backfilled portions of trenches.

Unless specified otherwise on the Design Plans or herein, all other backfill materials shall be compacted to a relative compaction of at least 85%.

Structural Backfill shall consist of material free of clasts and lumps exceeding 3 inches in greatest dimension, organic, and other unsatisfactory material as determined by Stillwater Sciences.

Structure Backfill shall have a Sand Equivalent value of not less than 20 and the following gradation:

U.S. Standard Sieve Size	% Passing
3 inch	100
No. 4	30–60
No. 30	5–35

Excavated material meeting the indicated conditions may be used as Structure Backfill.

### 6.2.2 Non-structural Backfill Material

Non-structural backfill material is to be sourced from recompacted, reused spoils from excavations conducted on site. Any additional non-structural backfill needed is to be bulk imported material that precludes establishment of Relative Compaction curves.

These Design Documents include “non-structural backfill”, consistent with, but not limited to: topsoil, stone, cobbles and large immobile boulders necessary to naturally: rebuild channel beds and banks, provide scour and instability protection, create large grade control features, and/or anchor large wood features.

Compaction effort can have a significant effect on the placed, finished, and weathered conditions of the completed site. Compaction effort exerted (over or under-compacted) is not readily determined or validated within these materials after placement is complete. Verification of relative compaction levels achieved by in-situ effort during the placement of backfill materials cannot always rely on typical “nuclear gauge” testing (ASTM D6938) due the inability to complete the lab or field portions because of the highly disparate grain size, often more than the standard diameter compaction tube used to calibrate the nuclear gauge results.

Compaction effort and relative density levels desired for the material and scope encompassed by the Design Documents will, unless otherwise noted therein, provide at a minimum the following compaction method, to be witnessed or validated by Stillwater Sciences during execution, unless otherwise waived, delegated, or deferred.

Lifts/lens/layers of backfill should not be deeper than 6 to 8 inches, unless needed to bed large immobile stone, or as indicated in the Design Documents. At the direction, and to the satisfaction, of Stillwater Sciences, between sequential lifts of backfill, the working region shall be “tamped”

with the bucket and randomly track-walked by multiple passes with the largest piece of equipment being used for the placement of backfill or sculpting of grades.

In general, any suitable excavated material should be used for backfill on top of logs and large wood structures and compacted to as close to 90% relative compaction as possible.

The necessary material specification and gradation for non-structural backfill will adopt the “structural backfill” material specifications, unless otherwise noted as one of the alternative materials herein (e.g. ESM).

If no alternative materials specification is used for the non-structural backfill, then the proposed material shall be free of clasts and lumps exceeding 3 inches in greatest dimension, organic, and other unsatisfactory material, or inherent material properties, as determined by the Engineer or Geologist.

Excavated material meeting the indicated conditions, may be used as non-structure backfill for most channel stabilization and habitat structures unless otherwise noted on the Design Plans.

Non-structure backfill shall have a Sand Equivalent value of not less than 20 and the following gradation:

U.S. Standard Sieve Size	% Passing
3 inch	100
No. 4	30–60
No. 30	5–35

### 6.3 Rough Grading

The Contractor shall excavate to the limits necessary to install the materials in the configuration indicated in the Design Documents.

The Contractor shall be aware of the subsurface conditions that are to be encountered during the progression of work and plan accordingly. Bedrock is common within the channel and thalweg of riverine systems, if bedrock is encountered and in conflict with the installation of proposed features indicated in the Design Documents, then the Contractor shall ask Stillwater Sciences for adjustment of the design feature in conflict prior to any design change being implemented in the field.

Although encountering bedrock is not expected at the work site, the Contractor shall be aware if there is bedrock within the riverbed of the project area and prepare for hard digging accordingly. Where the installation of any rock structures conflicts with existing bedrock, the Contractor shall cut into and notch the existing bedrock per the approval of the Stillwater Sciences such that placement of any large boulders, logs, or fill are supported against the flow of water, and do not roll off, rotate, or translate downstream.

A high groundwater table is expected to be a significant geotechnical constraint to the Project. Contractor should anticipate encountering groundwater during excavation of the pond and should plan accordingly. A plan to mitigate negative impacts of groundwater during earthwork should be provided to Stillwater Sciences for approval prior to implementation.

The Contractor shall not over-excavate unsuitable subgrade below the lower limit of excavations shown on the Design Documents, unless directed in writing by Stillwater Sciences. If over-excavation is necessary, the Contractor shall replace the over-excavated area, below the lower limit of planned excavations, with suitable material as determined and directed by Stillwater Sciences.

Earthen material generated from excavation that is not contaminated with construction debris and satisfies the “structural backfill”, “non-structural backfill”, or other material specification herein can be utilized as fill/backfill per the approval of the Stillwater Sciences (soil is preferred for some applications and must be excavated selectively for quality), stockpiled on site, or transported to another location at the Contractor’s expense.

All excess excavated material as well as unsuitable and/or oversized native material which cannot be used for backfill/fill purposes shall become the property of the Contractor and be disposed of at a legal dumpsite. No extra or separate payment will be made for stockpiling or re-handling of any material.

#### **6.4 Finish Grading**

The Contractor shall fine grade all slopes to eliminate rough or low areas and maintain channel slope and all levels, profiles, and contours of subgrade. Grades at work areas shall conform to the Design Plans. Depressed or mounded surfaces shall not be accepted. Finished grades are to be within 0.2 feet of the elevation shown on the Design Plans. Finish each area to present a neat and uniform appearance satisfactory to the Stillwater Sciences.

Grades not otherwise indicated shall be uniform levels (1% minimum) or slopes between points where elevations are given. Finished grades shall be smooth, even, and on a uniform plane with no abrupt change of surface.

All finish grades shall provide for positive runoff without low spots or pockets of water ponding more than 2 inches in depth. Stillwater Sciences shall inspect final grades prior to the completion of work.

Whenever reference to finish grade is made, it shall be considered to be the finished surface of graded channel embankments and/or any completed channel stabilization features (e.g., crossings, wood structures, excavations) as shown on the Design Plans.

Tolerances for finished grading shall be  $\pm 0.2$  feet vertical and  $\pm 0.5$  feet horizontal, unless otherwise specified in the Design Plans or by Stillwater Sciences.

#### **6.5 Erosion Prevention and Sediment Control**

Stillwater presumes that the Contractor will comply with the guidance and direction of the governing SWPPP or ESCP as it relates to the ongoing maintenance of BMPS and stormwater protection measures as they relate to ongoing excavation and earthwork, as discussed in Section 1.2 herein.

## **6.6 Temporary Access Features**

The Contractor shall be entirely responsible and liable for stability and safety of all temporary access features. Stillwater Sciences should be informed of any discrepancies on the Design Plans or other stability or safety concerns. The Contractor shall stay within specifically designated limits of work and access routes, as shown on the Design Plans. The Engineer or Geologist should be notified if any existing tree roots or existing geomorphological features, not noted on the Design Plans, will be impacted by temporary access features or construction equipment. Existing tree roots on banks should be preserved and protected by material specified by the Engineer or Geologist.

Temporary access features shall be composed of clean gravel installed in channels as shown on the Design Plans. Sites requiring dewatering shall be dewatered prior to installation of temporary access features unless otherwise noted on the Design Plans. Channel beds shall be thoroughly checked for structural stability to bear loads of construction equipment. Gravel ramps shall be entirely removed upon completion of project. Some temporary access features can be graded into the channel bed upon project completion if substrate size is suitable. If this option is not noted on the Design Plans, the Engineer or Geologist must be informed and provide approval before the beginning of project work; and gravel quality must be approved by the Engineer or Geologist.

## 7 ROCK STRUCTURES

### 7.1 General

This scope of work includes materials, purchase, delivery, site preparation, and placement of rock at the elevations and locations shown on the Design Plans and as directed by Stillwater Sciences. The various mixtures of rocks and backfill required for each structure shall be placed to the dimensions and at the locations shown on the Design Plans or as directed by Stillwater Sciences.

Rocks shall be placed by equipment suitable for handling material of the sizes required, and no dumping will be allowed. Caltrans Type A placement shall be used for all placement. In general, rocks should be placed in such a way to maximize stability with the largest flat side on the bottom, where possible. Plan view diagrams and cross sections shown on the Design Plans illustrate the rock placement intent, but adjustments may be made in the field as directed by the Stillwater Sciences.

These structures shall be constructed using the dimensions, elevations, and tolerances indicated on the Design Plans. All rock placement shall be reasonably homogeneous with larger rocks uniformly distributed and firmly in contact with one another and smaller rocks filling voids between larger rocks.

Hand or manual labor shall be used to place smaller rocks within the voids of the larger rocks to seal all gaps larger than 2–3 inches. No placed rock shall exhibit movement when walked upon. If necessary, iron bars and other methods such as manually manipulating the rock shall be used to ensure a solid mass of interlocking rock is constructed.

Plan view diagrams and cross sections shown on the Design Documents illustrate the rock placement intent, should the Contractor desire a change to grades or configuration within the Design Documents, they shall submit a formal RFI to be reviewed and approved by Stillwater Sciences prior to any change or material procurement; materials procured, staged, placed, and/or installed prior to concurrence being received from Stillwater Sciences is the Contractor’s responsibility.

### 7.2 Rock Structure Materials

All of the rocks imported to the site shall be fresh, hard, resistant to water action, and of a suitable quality to ensure permanence in the climate in which they are to be used. They shall be reasonably well graded and shall range in size as shown on the Design Plans. No broken concrete or asphalt shall be allowed. If possible, neither the width nor the thickness of any rock shall be less than one-third of its length. The general rock specifications for all types and mixes shall be:

Density (apparent specific gravity)	2.5 min per Caltrans
Rock gradation types	see table below for definition of each class
Durability index	52 min. per Caltrans, California Test 229
Soil material	Backfill rocks with suitable native excavated materials
Color	Rocks shall be of color which blends into the natural conditions of the area and must be approved by the Stillwater Sciences

Prior to commencement of the contract, the Contractor shall locate potential sources of rock, and the chosen quarry should be contacted a minimum of one month prior to the beginning of the project to ensure that sufficient rock is available.

Local sources of rock are preferred. Samples or documentation of rock color and durability shall be submitted to Stillwater Sciences to determine whether the rock meets the requirements as set forth in these Construction Specifications. If rock is to be used for rock slope protection (RSP), the Contractor shall be responsible for obtaining from the rock supplier a certification that the rock meets Caltrans Durability Specifications for rock riprap.

Rock class gradation table:

Nominal RSP class by median particle diameter <sup>b</sup>		Nominal median particle weight W <sub>50</sub> <sup>c,d</sup>	d <sub>15</sub> <sup>c</sup> (in)		d <sub>50</sub> <sup>c</sup> (in)		d <sub>100</sub> <sup>c</sup> (in)	Placement
Class <sup>a</sup>	Diameter (in)		Min	Max	Min	Max	Max	Method
I	6	20 lb	3.7	5.2	5.7	6.9	12.0	B
II	9	60 lb	5.5	7.8	8.5	10.5	18.0	B
III	12	150 lb	7.3	10.5	11.5	14.0	24.0	B
IV	15	300 lb	9.2	13.0	14.5	17.5	30.0	B
V	18	1/4 ton	11.0	15.5	17.0	20.5	36.0	B
VI	21	3/8 ton	13.0	18.5	20.0	24.0	42.0	A or B
VII	24	1/2 ton	14.5	21.0	23.0	27.5	48.0	A or B
VIII	30	1 ton	18.5	26.0	28.5	34.5	48.0	A or B
IX	36	2 ton	22.0	31.5	34.0	41.5	52.8	A
X	42	3 ton	25.5	36.5	40.0	48.5	60.5	A
XI	46	4 ton	28.0	39.4	43.7	53.1	66.6	A

<sup>a</sup>For RSP Classes I–VIII, use Class 8 RSP fabric. For RSP Classes IX–XI, use Class 10 RSP fabric.

<sup>b</sup>Intermediate or B dimension (i.e., width) where A dimension is length and C dimension is thickness.

<sup>c</sup>d%, where % denotes the percentage of the total weight of the graded material.

<sup>d</sup>Values shown are based on the minimum and maximum particle diameters shown and an average specific gravity of 2.65. Weight will vary based on specific gravity of rock available for the project.

All Caltrans Riprap of various Classifications indicated within the Design Documents shall comply with the following gradations and relevant material and placement specifications of Chapter 4, Section 72 of Caltrans’ Standard Specifications. Due to the placement of RSP within jurisdictional regions the use and application of subgrade geosynthetics do not apply; review the Design Documents for further guidance.

### 7.3 Rock Armor Placement

Rock armor will be placed at three locations as indicated by the Design Documents: 1) pond spillway, 2) Unnamed creek diversion, and 3) Streeter Creek diversion. Before placing rock armor and filler, prepare the subgrade to the required lines and grades shown on the Design Plans. Compact any local fill required in the subgrade to a density approximating that of the surrounding undisturbed material. Overfill any depressions with smaller backing rock or channel cobbles. Remove brush, trees, stumps and other objectionable material.

Rock armor structures provide bank and channel stabilization for critical project features and shall be constructed using the following gradations:

Pond Spillway:

- 100%—Caltrans Class I (6 inch, 20 lb)

Unnamed Creek Diversion:

- 80%—Caltrans Class III (12 inch, 150 lb)
- 20%—Caltrans Class I (6 inch, 20 lb)

Streeter Creek Diversion Bank Stabilization:

- 80%—Caltrans Class VII (24 inch, ½ ton)
- 20%—Caltrans Class III (12 inch, 20 lb)

Streeter Creek Large Wood Anchoring Boulders:

- 100%—Caltrans Class IX (36 inch, 2 ton)

Installation steps are as follows:

- Cut the subgrade sufficiently deep so that the finished grade of the rock armor will be at the approximate elevation of the surrounding banks. Channel toe should be excavated sufficiently to allow placement of the rock in a manner such that the finished inside dimensions and grade of the rock meets design specifications for toe depth and thickness as shown on the Design Plans. Allow for smooth transition and bank key-in at upstream and downstream extents.
- Place rock and soil backfill to its full thickness in a sequencing operation proceeding upslope from the toe in sections no more than 3 to 4 feet in slope length. Place rock so that it forms a dense, well-graded mass of stone with a minimum of voids. All rocks shall have a minimum of three contact points. Before finishing one section and proceeding to the next, voids in the newly placed rock shall be backfilled with soil, watered, and planted with live willow cuttings, where suitable (see below).
- Do not place rock by dumping through chutes or other methods that cause segregation of rock sizes. Use Caltrans Type A placement. Take care not to dislodge the underlying base or filter when placing rock.
- The toe of the rock slope should be keyed into a stable foundation at its base. The toe should be excavated to a depth approximately 1.5 times the design thickness of the rock armor and should extend horizontally from the slope, or as shown on the Design Plans.
- The finished slope should be free of clusters of small rocks, except where chinked into voids. Some final hand placing with a cable or wrecking bar may be necessary to achieve the proper distribution of rock sizes to produce a relatively smooth, uniform surface.
- The finished grade of rock armor should be apparent and should transition smoothly to adjacent slopes.
- rock armor placement shall be reasonably homogeneous with larger rocks uniformly distributed and firmly in contact with one another, with smaller rocks filling voids between larger rocks.
- Rocks shall be placed by equipment suitable for handling material of the sizes required. Armor and toe rocks shall be placed to the grades shown on the Design Plans and cross sections. The intention is for the rock armor to be built to at least the grade lines, with the outer surfaces reasonably even and uniform in appearance, and without extreme ranges in

tolerance between adjacent rocks. Hand labor shall be utilized as required to improve rock arrangement and produce thickness and surface as specified, and a neat appearance.

- Construct rock armor to slope gradient and dimensions shown on the Design Plans to avoid or minimize impingement of toe section into low-flow channel.
- Willow cuttings shall be installed while the rock is being placed. Plantings shall average 4 to 5 feet on center, inserted into soil. Willows should be planted as soon as possible after harvesting. Cut willows should be stored in water prior to planting no longer than 72 hours. Willow cuttings must be harvested from local sources, either on the site or from nearby drainages.
- Backfill joint/voids with soil to near top of crowns of rock after placement of willow cuttings. Cut off willow cuttings to no more than 10 inches above grade. Minimize damage to willow cuttings by final course local hand placement of soil. If necessary, trim off damaged ends of willow cuttings.

#### **7.4 Backfill Drain Gravel**

Drain gravel to place around the perforated pipe underneath the pond liner will consist of ~1 inch minus drain gravel (maximum 3/4 inch). This material shall be well-graded, clean, hard, durable, conforming to ASTM C33 and per Section 200-1.3 “Gravel” of the SSPWC (Greenbook).

Drain gravel shall be placed around the perforated pipe with careful precision either by hand or by small machinery to avoid damaging the perforated pipe or disrupting its position near the trench bottom. The drain rock shall be encapsulated by geotextile fabric as shown on the Design Documents.

#### **7.5 Pond Liner Topper Gravel**

Gravel to place on top of the pond liner and geotextile fabric shall consist of gravel material that passes a 3 inch screen but does not pass a 1 inch screen. This material shall be angular, crushed, relatively clean, hard, and durable, conforming to ASTM C33 and per Section 200-1.3 “Gravel” of the SSPWC (Greenbook).

Liner topper gravel shall be placed on top of the liner and geotextile fabric by either excavator or rubber tracked skid-steer with careful precision to avoid damaging the liner. Either benching, slot grading, and/or wrapped perforated pipe curb shall be installed prior to gravel placement to secure gravel topper within desired areas shown on the Design Documents. The only equipment allowed on top of the liner shall be a rubber tracked skid-steer. A minimum of 6 inch thickness of gravel must be placed on top of the liner prior to rubber tracked skid-steer access.

## **8 LARGE WOOD STRUCTURES**

### **8.1 General**

This scope of work includes purchase, delivery, site preparation, and placement of Large Wood Structures including all materials, excavation, fill, compaction, rock placement, and anchoring required to install the features at the elevations and locations shown on the Design Plans and as directed by Stillwater Sciences. Plan view diagrams and cross sections shown on the Design Plans illustrate the wood placement intent, but adjustments may be made in the field as directed by the Stillwater Sciences.

The general anchoring techniques used for this project will follow procedures listed in the CDFW Restoration Manual with log-to-log and log-to-rock anchoring. Log-to-log connections shall be made with threaded rebar. Log-to-rock anchoring shall use 7/8-inch diameter threaded rebar and large chain as described in the Design Documents. This will provide clean and durable connections and eliminates the need for cable which is more likely to rust and break down over time.

### **8.2 Source of large wood**

The contractor shall be responsible for sourcing of the large wood but it is anticipated that wood can be sourced from the area to be cleared for the rainwater catchment tanks.

### **8.3 Logs and rootwads**

Rootwads shall include the root mass/ root ball of a tree and a portion of the trunk. Care should be taken to preserve as much of the root material as possible in transport, as it provides critical fish habitat and debris retention capability. Contractor should refer to the Design Plans for length of trunk required at specific locations. Logs and rootwads should generally have a minimum basal diameter of 18 inches unless otherwise approved by Stillwater Sciences. Logs and rootwads should generally be Douglas fir or coastal redwood in good condition with no rot, visible cracks, large knots, mold, or decayed wood. Other species may be used if approved by Stillwater Sciences.

### **8.4 Anchoring materials**

- Logs shall be in good condition with no rot and must be Douglas fir, coastal redwood, or other species to be approved by the Engineer or Geologist.
- Logs shall be of sufficient quality to provide structural integrity to the Large Wood Structures. No visible cracks, large knots, moldy, or decayed wood shall be accepted.
- Log lengths and diameters shall be determined from the Design Documents.
- All nuts shall conform to ASTM A563, and all reinforcing steel shall conform to ASTM A615.
- 7/8" diameter threaded reinforcing steel shall be Williams Form #7 Grade 75 All-Thread Rebar or equivalent.
- 1" threaded reinforcing steel shall be Williams Form #8 Grade 75 All-Thread Rebar or Equivalent.
- 7/8" diameter nuts shall be Williams Form #7 Grade 75 R63 Hex Nut 1.25" length or equivalent.

- 1" diameter nuts shall be Williams Form #8 Grade 75 R63 Hex Nut 1.375" length or equivalent.
- Chain shall be 1" Grade 43 or equivalent
- Square washers shall be 3" X 3" X 3/8" thick Grade 50 Steel plate washers with 1 3/16" drilled hole.
- Epoxy shall be Hilti HIT-RE 500 Epoxy System or approved equivalent.

## **8.5 Placement**

Below is a general procedure for installation of large wood structures although this can be modified based on site conditions or as directed by Stillwater Sciences.

- After rough grading to the finish grades and lines shown on the Design Plans excavate trench into bank for placement of the Large Wood Structure where specified. The trench should be of sufficient width and depth to accommodate a log and anchor boulders as shown on the Design Plans.
- Where wood to wood connections are made, logs shall be pinned together with threaded rebar and 3 inch by 3inch square washers as shown on the Design Plans.
- At log to boulder anchors, position anchoring points as close together as possible and use methodologies shown on the Design Plans and as described in the epoxy manufacturers specifications.
- Anchoring redundancy should be conducted as directed by Stillwater Sciences.
- Place willow cuttings in and around Large Wood Structures.
- Place specified size and number of rocks around Large Wood Structures as shown on Design Plans for anchorage so that Wood Structures will not be dislodged by high flow.
- Backfill and compact trenches with native substrate and/or rock armor, as applicable.

## 9 PLUMBING

### 9.1 General

This section includes piping, fittings, valves, gauges, backflow preventers, and other plumbing devices and components. All products in contact with potable water shall comply with NSF/ANSI 61 and NSF/ANSI 372 (max lead standards), along with NSF/ANSI 14 for plastic potable-water-service piping. All pipes, fittings, fixtures, solder, and flux shall meet the 0.25% maximum lead content rules for all wetted components.

All plumbing appurtenances shall be new and unused, of the type, pressure rating or class, and size specified and as shown on the Drawings. Unless otherwise noted, the minimum working pressure for piping and specialty valves and devices shall be 160 psig. Select system components with pressure rating equal to or greater than system operating pressure. Install piping at indicated slopes, free of sags and bends.

The following submittals shall be provided to the Engineer for all materials herein, at the earliest date possible after receipt of the Notice to Proceed and prior to delivery to the project site:

- Product Data demonstrating conformance with the Design Documents.
- Shop Drawings detailing fabrication, layout, quantities, sizes, and materials.
- Manuals for installation and maintenance.

### 9.2 Standards

Piping Standards relevant to materials and installation within the Design Documents shall, at a minimum, comply with the following specifications, unless otherwise exempted.

- Typical piping joints shall comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
- All PVC Pressure Piping presumes joining ASTM D 1785 PVC pipe and PVC socket fittings according to ASTM D 2672. Join all other PVC pipe and socket fittings according to ASTM D 2855.
- All Valves shall correspond with ASME B1.20.1, ASME B16.19, and ASME B31.9 as applicable.
- All systems should be pressure tested prior to burial and final hookup.

### 9.3 Piping Materials

Piping materials installed as part of the Design Documents shall, at a minimum, comply with the following material specifications, unless otherwise exempted.

#### 9.3.1 PVC Piping and Fittings

Typical Piping shall be consistent with AWWA C900 Class 150 with fittings that comply with AWWA C900 or approved equivalents.

- PVC Fabricated Fittings shall be AWWA C900, Class 150, with bell-and-spigot or double-bell ends, with an elastomeric gasket included within each bell.

- PVC Molded Fittings shall be AWWA C907, Class 150, with bell-and-spigot or double-bell ends, with an elastomeric gasket included within each bell.
- Ductile-Iron Fittings shall be compliant with AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
- Gaskets shall be “rubber” in accordance with AWWA C111, with Mechanical-Joint and Ductile-Iron Fittings in compliance with AWWA C110 for ductile- or gray-iron standard pattern, and AWWA C153 for ductile-iron compact pattern. Glands, Gaskets, and Bolts shall be consistent with AWWA C111 for ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- When/if fusing PVC Piping with solvent/cement it shall be in accordance with ASTM D 2564 and include a primer according to ASTM F 65.
- Comply with UL 1285 for fire-service mains if indicated.

### **9.3.2 HDPE Piping and Fittings**

Typical piping shall be consistent with AWWA C901; with a material designation of PE 4710 resin; and a minimum cell classification per ASTM D 3350, 445574C; and minimal Dimension Ratio and Minimum Pressure Rating in accordance with CTS DR9. Piping shall be provided in 40-foot lengths, rather than in rolls.

All “molded” HDPE Fittings shall be consistent with ASTM D 3350, PE 4710 resin, butt-fusion type, made to match HDPE pipe dimensions and class.

Pipe and fittings 4-inch diameter and larger shall confirm to AWWA C906 in addition to above requirements.

### **9.3.3 Galvanized/Steel Piping and Fittings**

All Typical piping shall be consistent with ASTM A53, Schedule 40 thickness and threaded ends meeting ASME B1.20.1 standard. Fittings shall be threaded and comply with ASTM A 338.

### **9.3.4 Bronze Fittings for Galvanized, Steel, and NPT Piping**

All Typical piping shall be consistent with ASTM A53, Schedule 40, threaded ends meeting ASME B1.20.1. standard. Fittings shall be threaded and comply with ASTM A 338.

Bronze ball valves shall be Model # LFB6000 Lead Free Ball Valve as manufactured by Watts Regulator, or an approved equal.

Bronze globe valves shall be Model # Powell Class 150 as manufactured by Wm. Powell Company, or No. 7, as manufactured by the Crane Company, Chicago, or an approved equal.

Bronze gate valves shall be Model # Powell Gate Valve Class 150, as manufactured by Powell Company or No. 437, as manufactured by the Crane Company, or an approved equal.

Bronze check valves shall be Model # Figure No. 578 as manufactured by Powell Company, or an approved equal.

Pressure gauges shall be Model # Ashcroft 1005 as manufactured by Dresser Industries, or an approved equal, with a 2-inch diameter or larger, 0 to 200 psi range, brass movement, and steel case bottom mounting with NPS 0.25 threads. A ball valve for gauge isolation is presumed included herein.

Pressure regulators shall be complaint with NSF 61-G and certified by ASSE 1003, such as model # LFU5B as manufactured by Watts, or an approved equal, with a heavy-duty rugged design, easy survivability on potable water systems, and a corrosion resistant cast-iron spring cage and

Unions for piping shall be Female type, malleable iron, 150 pound, with ground brass to iron seat. Sample Taps shall be Model # P/N 301PE as manufactured by Arrowhead Brass, or an approved equal, with a 1/2-inch brass hose bib a male inlet and smooth-nosed outlet.

Wye-strainers shall be Model # Style B or F, as manufactured by O. C. Keckley Company, or Model: P/N LF777S, as manufactured by Watts Regulator Company, or an approved equal, with a 125 psi minimum working pressure, semi-steel or bronze body with threaded ends, with brass plug in blow-off connection and removable stainless steel #30 mesh screen.

Backflow preventers “check valves” up to NPS 2 shall be constructed with a bronze body, threaded ends, and be consistent with the ASSE standard for backflow preventers and provide a minimum working pressure of 150 psig, unless otherwise indicated. Backflow preventers shall be Manufactured by Watts Regulator Company, or an approved equal. All interior lining of backflow preventers shall be compliant with AWWA C550 or FDA-approved, epoxy coating for backflow preventers having cast-iron or steel bodies. All Interior Components of backflow preventers shall be made of corrosion-resistant materials. A Strainer on the inlet end is presume included herein.

Double-Check-Valve Backflow Prevention Assemblies shall all be FM approved and in compliance with UL 312; with two UL 312, iron-body, 175-psig working-pressure, flanged-end check valves; and two UL 262, iron-body, outside screw and yoke, flanged, 175-psig working-pressure gate valves. The unit shall not lose more than 5psig through the middle ~1/3 of the rated flow range.

### **9.3.5 Flanged Gate Valve with Hand-wheel**

Flanged gate valve with hand-wheel shall meet AWWA C515 standard and feature a ductile iron body and bonnet, class 150 flange, stainless steel non-rising stem, wax encapsulated cap screws, bronze wedge nut, and fusion bonded epoxy coating.

All flanged gate valves, with hand-wheel, shall be Model # 017110FW, ductile iron AWWA 250lbs gate valve with flanges and hand wheel, as manufactured by Smith Cooper, or an approved equal.

### **9.3.6 Water meter**

Water meter(s) (flow meter(s)) shall be certified to NSF/ANSI standard 61/IP68 rated with flanged electromagnetic flowmeter, with minimal straight pipe, mounted or remote display, tamper evident seal, battery or external DC power source, and pulse output standard.

All water meters/flow meters, shall be Model # iMAG 4700 Magmeter, as manufactured by Seametrics, or an approved equal.

### **9.3.7 Air/Vacuum valve for pipelines**

Air/Vacuum valves shall comply with AWWA C512 and provide a hydromechanical device with large orifice to automatically release large quantities of accumulated air under pressure or to admit large quantities of air during filling of piping, with cast iron body, stainless steel float, 175-psig rated working pressure, and NPS 1 threaded inlet.

### **9.3.8 Perforated Drain Pipe**

Perforated PVC drain pipe shall be smooth wall 4-inch diameter schedule 80 PVC and comply with AASHTO M252, M278, and M294 standards for the size(s) indicated on the Design Documents. All perforations shall provide at least one line that can be pointed downward when installed; each perforation shall be between 3/8 inch and 1/2 inch in diameter. Perforations shall be grouped into 4 perforations, with 2 perforations at 90 degrees apart, and 2 perforations at 160 degrees apart.

## **9.4 Valve Boxes**

Valve and meter boxes housing the control valves and various meters gauges and critical connection points of the piping system proposed within the Design Documents shall be housed in an appropriately scaled valve meter housing box with corresponding lid (valve box). These valve boxes will vary in size, depth, number and type of piping components and valving housed within; however, all meter boxes installed to satisfy the Design Documents herein shall be a minimum Fiberlyte brand as manufactured by Oldcastle Infrastructure within the: FL08, FL09, FL12, FL30, or FL36 model line provided with corresponding lid, or approved equivalent.

### **9.4.1 Submittals**

Submit shop drawings showing compliance with the construction specifications herein, prior to fabrication and procurement for review and approval by Stillwater Sciences; materials procured before receipt of this approval and concurrence are the responsibility of the Contractor.

## **10 ELECTRICAL SYSTEMS**

### **10.1 General**

This section includes specification of electrical conduits, conductors, enclosures, and other electrical devices and components. All installation of electrical components shall conform to the latest edition of the California Building Code (CBC) and National Electrical Code (NFPA 70) with grounding conductors in compliance with ASTM B3.

The general intent of this specification is to provide guidance to the Contractor and enlist their knowledge and expertise to recommend a compliant electrical system that provides the desired operational criteria and meets all relevant codes. This specification generally assumes copper wire running in buried schedule 40 PVC conduit. However, should the Contractor have a more economical and efficient configuration available than that assumed herein that meets operational criteria and code, this specification can be revised to reflect that proposed configuration.

The following submittals shall be provided to the Engineer for all materials herein, at the earliest date possible after receipt of the Notice to Proceed and prior to delivery to the project site:

- Product Data demonstrating conformance with the Design Documents.
- Shop Drawings detailing fabrication, layout, quantities, sizes, and materials.
- Manuals for installation and maintenance.

### **10.2 Standards**

Electrical standards relevant to materials and installation within the Design Documents shall, at a minimum, comply with the following specifications, unless otherwise exempted.

### **10.3 Copper Conductor Wire**

All Copper conductor wire shall be flexible, insulated and uninsulated copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

The conductor type, insulation, and intended application shall comply with one of the appropriate type and UL listing as follows:

- Type NM. Comply with UL 83 and UL 719.
- Type RHW-2. Comply with UL 44.
- Type USE-2. Comply with UL 854.
- Type TC-ER. Comply with NEMA WC 70/ICEA S-95-658 and UL 1277.
- Type THHN and Type THWN-2. Comply with UL 83.
- Type THW and Type THW-2. Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
- Type UF. Comply with UL 83 and UL 493.
- Type XHHW-2. Comply with UL 44
- Type SJOW/SJOOW UL compliant and CSA certified.

### 10.4 Aluminum Conductor Wire

If selected for use by the Contractor, all aluminum conductor wire shall be flexible, insulated and uninsulated aluminum current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use. The Contractor has the option to use aluminum conductor wire when designing the electrical system, but it is not a required material.

Aluminum conductor wire shall be selected for the intended application and comply with ASTM B800 and ASTM B801. The conductor type shall have insulation complying with one of the appropriate insulations types listed below:

- Type USE-2. Comply with UL 854
- Type THWN-2. Comply with UL 83
- Type XHHW-2. Comply with UL 44

### 10.5 PVC Electric Conduit

The use of rigid polyvinyl chloride (PVC) conduit shall be permitted in accordance with National Electrical Code (NEC) Article 352.10 (A) through (I). Typically, schedule 40 conduit may be used for underground burial and within enclosures. Schedule 80 conduit should be used in applications with exposure to sunlight. Bends shall be made so that the conduit will not be damaged, and the internal diameter of the conduit will not be effectively reduced. PVC conduits shall be securely fastened within 3 feet of each outlet box, junction box, device box, conduit body, or other conduit termination. The use of PVC conduit shall comply with NEC article 352 in all other cases. PVC conduit smaller than trade size ½ or greater than trade size 6 shall not be used.

The number of conductors shall not exceed that permitted by the percentage fill specified in the table below:

Metric Designator	Trade Size	Over 2 Wires 40%		60%		1 Wire 53%		2 Wires 31%		Nominal Internal Diameter		Total Area 100%	
		mm <sup>2</sup>	in. <sup>2</sup>	mm <sup>2</sup>	in. <sup>2</sup>	mm <sup>2</sup>	in. <sup>2</sup>	mm <sup>2</sup>	in. <sup>2</sup>	mm	in.	mm <sup>2</sup>	in. <sup>2</sup>
12	¼	—	—	—	—	—	—	—	—	—	—	—	—
16	½	56	0.087	85	0.130	75	0.115	44	0.067	13.4	0.526	141	0.217
21	¾	105	0.164	158	0.246	139	0.217	82	0.127	18.3	0.722	263	0.409
27	1	178	0.275	267	0.413	236	0.365	138	0.213	23.8	0.936	445	0.688
35	1½	320	0.495	480	0.742	424	0.656	248	0.383	31.9	1.255	799	1.237
41	1½	442	0.684	663	1.027	585	0.907	342	0.530	37.5	1.476	1104	1.711
53	2	742	1.150	1113	1.725	983	1.523	575	0.891	48.6	1.913	1855	2.874
63	2½	1064	1.647	1596	2.471	1410	2.183	825	1.277	58.2	2.290	2660	4.119
78	3	1660	2.577	2491	3.865	2200	3.414	1287	1.997	72.7	2.864	4151	6.442
91	3½	2243	3.475	3365	5.213	2972	4.605	1738	2.693	84.5	3.326	5608	8.688
103	4	2907	4.503	4361	6.755	3852	5.967	2253	3.490	96.2	3.786	7268	11.258
129	5	4607	7.142	6911	10.713	6105	9.463	3571	5.535	121.1	4.768	11518	17.855
155	6	6605	10.239	9908	15.359	8752	13.567	5119	7.935	145.0	5.709	16513	25.598

### 10.6 Electrical Enclosures and Junction/Pull Boxes

Electrical enclosures, junction boxes, and conduit bodies shall be NEMA rated of an approved size to provide free space for all enclosed conductors and intended for application. In no case shall the volume of the box, as calculated in 314.16(A), be less than the fill calculation as calculated in 314.16(B). The minimum volume for conduit bodies shall be as calculated in

314.16(C). The provisions of this section shall not apply to terminal housings supplied with motors or generators. Boxes and conduit bodies enclosing conductors 4 AWG or larger shall also comply with the provisions of 314.28. Outlet and device boxes shall also comply with 314.24.(A).

Metal boxes shall be grounded and bonded in accordance with Parts I, IV, V, VI, VII, and X of Article 250 as applicable, except as permitted in 250.112(1) within the NEC. Nonmetallic boxes shall be permitted only with open wiring on insulators, concealed knob-and-tube wiring, cabled wiring methods with entirely nonmetallic sheaths, flexible cords, and nonmetallic raceways.

The use of electrical enclosures shall comply with NEC article 314 in all other cases.

No below-grade junction or pull boxes shall be constructed as part of the project.

## **10.7 Pumps**

### **10.7.1 Transfer pump for irrigation supply**

The transfer pump shall draw water from the pond to supply the farm and camp.

The transfer pump at the pond shall be a self-priming, centrifugal pump intended for irrigation and sprinkler applications designed for long-duration continuous operation. The transfer pump unit shall be housed and provided with a complaint enclosed structure with adequate thermal and vapor retardation and footing for stability.

The transfer pump shall run near its optimal efficiency range and provide delivery of at least 16 gpm (gallons per minute) of water from its intake at the bottom of the pond, operating under system conditions that have at least 50 ft of total dynamic head (TDH) and up to 20 ft of suction head will be required during all operation, and a minimum required line pressure of 40psi (pounds per square-inch) shall be maintained throughout, as measured at the outlet(s) of the piping runs. Pump inlets and outlets match typical system piping diameter of 1.5"; the suction draw line shall not exceed this diameter.

The electric motor drive shall be a standard single-phase, 60HZ, 3,500 rpm (rotations per minute) motor, featuring built in overload protection with auto-reset, a NEMA standard open drip-proof body, and a stainless-steel motor drive shaft. The impeller shall be constructed of a high-quality, glass-filled, abrasion resistant engineered composite.

The body casing of the transfer pump shall be a high-quality, painted, cast-iron housing with anchorage bolt locations and a conveniently accessed maintenance port. Mechanical seals shall be at least carbon/ceramic faces with Buna elastomers, 300 series stainless steel metal parts, and an integral diaphragm to prevent the seals from running dry.

Transfer pump shall be the single-phase 1HP (horse-power) self-priming centrifugal pump manufactured by Goulds, GT irrigator pump, model # GT10; or approved equal.

The pump shall be provided a master control switch governed by control wires within a conduit routed within the typical joint trench to the "Farm/Office" building ~750 feet away where a NEC/NEMA rated, manual, wall-mounted on/off switch with guard, cover, and lock, can be installed and conveniently operated. If switch is exterior mounted, it shall comply with the "Electrical enclosures and junction/pull boxes" specification herein. Wire gauge to comply with pump vendor recommendations and shall supply the voltage necessary for pump activation over the anticipated distances, consult provided pump specifications. Control wires shall comply with the specifications for "Copper conductor wire" herein. The waterproof continuous conduit shall comply with the "PVC electrical conduit" specification herein.

Operation of the transfer pump presumes the presence of a mutually exclusive physical valving or similar piping manifold that will supply water to one of the two outlets at any given time.

Stillwater presumes all components will be installed in accordance with the governing vendor manuals. The Contractor shall successfully conduct operational and functional pump system tests in accordance with the vendor recommendations and manuals.

Performance data, curves, and cutsheets are provided for equivalence in the Appendix to these Specifications.

### **10.7.2 Groundwater return pump**

The Groundwater return pump (GW pump) below the pond shall be a high-efficiency 4-inch diameter multi-stage submersible well pump type with a 1.25-inch discharge line, check valve, and an integral sand protection system, dry-run protection, suitable for inclined operation, and intended for: groundwater supply to waterworks, irrigation in horticulture and agriculture, and domestic water supply.

The pump shall feature 100% corrosion resistant stainless-steel construction with a high resistance to sand and other abrasives, with an inlet screen and “sand channels” provided within the bearings to flush sand particles with transported water. Stillwater presumes the operation of the pump will avoid exposure to mobilized or disturbed sediments so that the pump is only transporting clean clear water.

The motor shall have a sealed shaft assembly with a stop ring and upthrust protection to minimize risk of damage during transport and operation, a priming screw to ensure bearings and seals do not run dry, and the pump shall be sufficiently secured from movement during start and stop operation.

The GW pump unit shall lower down an angled well casing sleeve directly by the 1.25-inch discharge line, into a sump chamber (wet well), where it will be submerged and draw water directly. The sump chamber is situated below the pond liner and supplied incoming sources of intercepted groundwater from the connected french drain system that extends beneath the pond liner. The 1.25-inch diameter discharge line from the GW pump will extend up the well casing and discharge water directly into the pond; an operable and convenient flow control valve shall be included in this piping run and is required to limit the discharge rate during pump startup procedures.

The GW pump shall run near its optimal efficiency range and provide delivery of at least 16 gallons per minute (gpm) of water from its intake in the sump chamber below the pond, operating under system conditions that have at least 50 ft of total dynamic head (TDH) will be required during all operation. The discharge will occur directly into the pond and will not have a pressure condition within the line.

The electric motor drive shall be a standard single-phase, 60HZ, ~3,500 rpm (rotations per minute) motor, featuring built in over-temperature protection and overload protection with auto-resets, and dry-run protection.

The pump shall be the single-phase 0.75 horse-power (HP) 4-inch diameter, multi-stage, well pump with 1.25-inch discharge line, manufactured by Grundfos, model # SP16S 07-8; or approved equal.

The pump shall be provided a with master control switch governed by control wires within a conduit routed ~150 feet to the pump house enclosure specified within the “Transfer pump” specification, where a NEC/NEMA rated, manual, wall-mounted on/off switch with guard, cover, and lock, can be installed and conveniently operated. If switch is exterior mounted, it shall comply with the “Electrical enclosures and junction/pull boxes” specification herein. Wire gauge to comply with pump vendor recommendations and shall supply the voltage necessary for pump activation over the anticipated distances, consult provided pump specifications. Control wires shall comply with the specifications for “Copper conductor wire” herein. The waterproof continuous conduit shall comply with the “PVC electrical conduit” specification herein.

Stillwater presumes all components will be installed in accordance with the governing vendor manuals. The Contractor shall successfully conduct operational and functional pump system tests in accordance with the vendor recommendations and manuals.

Performance data, curves, and cutsheets are provided for equivalence in the Appendix to these Specifications.

### **10.7.3 Streeter diversion submersible pump - larger capacity**

The submersible well pump supplying the water tank system and/or pond shall be a high-efficiency 4-inch diameter multi-stage submersible well pump type with a 1.5-inch discharge line, check valve, and an integral sand protection system, dry-run protection, suitable for inclined operation, and intended for groundwater supply to waterworks, irrigation in horticulture and agriculture, and domestic water supply.

The pump shall feature 100% corrosion resistant stainless-steel construction with a high resistance to sand and other abrasives, with an inlet screen and “sand channels” provided within the bearings to flush sand particles with transported water. Stillwater presumes the operation of the pump will avoid exposure to mobilized or disturbed sediments so that the pump is only transporting clean clear water.

The motor shall have a sealed shaft assembly with a stop ring and upthrust protection to minimize risk of damage during transport and operation, a priming screw to ensure bearings and seals do not run dry, and the pump shall be sufficiently secured from movement during start and stop operation.

The pump unit shall lower down well casing sleeve directly by the 1.5-inch discharge line, into a sump chamber (wet well), placed vertically along one wall of the wet well it will be submerged in the bottom and draw water directly. The sump chamber (wet well) is situated off-channel adjacent to, and separate from, the Streeter intake structure and uses pipes to convey intercepted creek water into the wet well.

The wet well will be shared with the other diversion pump at the Streeter diversion, but the two pumps should not have any other shared inlet components. The 1.5-inch diameter discharge line from the pump will extend up the well casing and discharge water directly into the tank and/or pond; an operable and convenient flow control valve shall be included in this piping run and is required to limit the discharge rate during pump startup procedures.

The pump shall run near its optimal efficiency range and provide delivery of at least 30 gpm of water from its intake in the wet well at the Streeter diversion, operating under system conditions that have at least 150 ft of total dynamic head (TDH) will be required during all operation. The discharge will occur directly into the top of the tank system and will not have a pressure condition within the line.

The electric motor drive shall be a standard single-phase, 60HZ, ~3,500 rpm (rotations per minute) motor, featuring built in over-temperature protection and overload protection with auto-resets, and dry-run protection.

The larger submersible well pump supplying the pond and/or water tank system shall be the single-phase 1.5 HP 4-inch diameter, multi-stage, well pump with 1.5-inch discharge line, manufactured by Grundfos, model # SP35S 15-6; or approved equal.

The pump shall be provided with a master control switch governed by control wire(s) within conduit(s) routed ~100 feet to the existing pre-treatment shed enclosure shown in the Design Documents, where a NEC/NEMA rated, manual, wall-mounted on/off switch with guard, cover, and lock, can be installed and conveniently operated. If switch is exterior mounted, it shall comply with the “Electrical enclosures and junction/pull boxes” specification herein. The waterproof continuous conduit shall comply with the “PVC electrical conduit” specification

herein. Wire gauge to comply with pump vendor recommendations and shall supply the voltage necessary for pump activation over the anticipated distances, consult provided pump specifications. Control wires shall comply with the specifications for “Copper conductor wire” herein.

In addition to a master control switch, the pump shall have an automated float activation system with control wires routed within conduits as needed to create activation logic and desired runtime routine as described by the “Float and control wire”, “Streeter diversion”, specification below.

Stillwater presumes all components will be installed in accordance with the governing vendor manuals. The Contractor shall successfully conduct operational and functional pump system tests in accordance with the vendor recommendations and manuals.

Performance data, curves, and cutsheets are provided for equivalence in the Appendix to these Specifications.

#### **10.7.4 Streeter diversion submersible well pump - smaller capacity**

The submersible well pump supplying the water tank system shall be a high-efficiency 4-inch diameter multi-stage submersible well pump type with a 1.25-inch discharge line, check valve, and an integral sand protection system, dry-run protection, suitable for inclined operation, and intended for: groundwater supply to waterworks, irrigation in horticulture and agriculture, and domestic water supply.

The pump shall feature 100% corrosion resistant stainless-steel construction with a high resistance to sand and other abrasives, with an inlet screen and “sand channels” provided within the bearings to flush sand particles with transported water. Stillwater presumes the operation of the pump will avoid exposure to mobilized or disturbed sediments so that the pump is only transporting clean clear water.

The motor shall have a sealed shaft assembly with a stop ring and upthrust protection to minimize risk of damage during transport and operation, a priming screw to ensure bearings and seals do not run dry, and the pump shall be sufficiently secured from movement during start and stop operation.

The pump unit shall lower down well casing sleeve directly by the 1.25-inch discharge line, into a sump chamber (wet well), placed vertically along one wall of the wet well it will be submerged in the bottom and draw water directly. The sump chamber (wet well) is situated off-channel adjacent to, and separate from, the Streeter intake structure. Piping to convey intercepted creek water into the wet well. The wet well will be shared with the other diversion pump at the Streeter diversion, but the two pumps should not have any other shared inlet components. The 1.25-inch diameter discharge line from the pump will extend up the well casing and discharge water directly into the tank; an operable and convenient flow control valve shall be included in this piping run and is required to limit the discharge rate during pump startup procedures.

The pump shall run near its optimal efficiency range and provide delivery of at least 16gpm (gallons per minute) of water from its intake in the wet well at the Streeter diversion, operating under system conditions that have at least 150 ft of total dynamic head (TDH) will be required during all operation. The discharge will occur directly into the top of the tank system and will not have a pressure condition within the line.

The electric motor drive shall be a standard single-phase, 60HZ, ~3,500 rpm (rotations per minute) motor, featuring built in over-temperature protection and overload protection with auto-resets, and dry-run protection.

The smaller submersible well pump supplying the water tank system shall be the single-phase 0.75 HP 4-inch diameter, multi-stage, well pump with 1.25-inch discharge line, manufactured by Grundfos, model # SP16S 07-8; or approved equal.

The pump shall be provided with a master control switch governed by control wire(s) within conduit(s) routed ~100 feet to the existing pre-treatment shed enclosure shown in the Design Documents, where a NEC/NEMA rated, manual, wall-mounted on/off switch with guard, cover, and lock, can be installed and conveniently operated. If switch is exterior mounted, it shall comply with the “Electrical enclosures and junction/pull boxes” specification herein. The waterproof continuous conduit shall comply with the “PVC electrical conduit” specification herein. Wire gauge to comply with pump vendor recommendations and shall supply the voltage necessary for pump activation over the anticipated distances, consult provided pump specifications. Control wires shall comply with the specifications for “Copper conductor wire” herein.

In addition to a master control switch, the pump shall have an automated float activation system with control wires routed within conduits as needed to create activation logic and desired runtime routine as described by the “Float and control wire”, “Streeter diversion”, specification below.

Stillwater presumes all components will be installed in accordance with the governing vendor manuals. The Contractor shall successfully conduct operational and functional pump system tests in accordance with the vendor recommendations and manuals.

Performance data, curves, and cutsheets are provided for equivalence in the Appendix to these Specifications.

#### **10.7.5 Camp rain catchment and pre-treatment pumps**

The submersible well pump supplying the water tank system shall be the same specification as the submersible well pump within the pre-treatment tank. The following specification is applicable to both pumps, and the presumption is that the same pump will be obtained at each location; therefore, the term “pump” will be used for both pumps generically and any differences will be indicated. The submersible well pump in both the camp rain catchment tank and the pretreatment tank shall both be a high-efficiency 4-inch diameter multi-stage submersible well pump type with a 1.25-inch discharge line, check valve, and an integral sand protection system, dry-run protection, suitable for inclined operation, and intended for: groundwater supply to waterworks, irrigation in horticulture and agriculture, and domestic water supply

The pump shall feature 100% corrosion resistant stainless-steel construction with a high resistance to sand and other abrasives, with an inlet screen and “sand channels” provided within the bearings to flush sand particles with transported water. Stillwater presumes the operation of the pump will avoid exposure to mobilized or disturbed sediments so that the pump is only transporting clean clear water.

The motor shall have a sealed shaft assembly with a stop ring and upthrust protection to minimize risk of damage during transport and operation, a priming screw to ensure bearings and seals do

not run dry, and the pump shall be sufficiently secured from movement during start and stop operation.

The pump shall run near its optimal efficiency range and provide delivery of at least 16gpm (gallons per minute) of water from its intake in the wet well (tank), operating under system conditions that have at least 150 ft of total dynamic head (TDH) will be required during all operations. The discharge will occur directly into the top of the tank system or into the inlet end of a pretreatment system, at each location as detailed below.

The electric motor drive shall be a standard single-phase, 60HZ, ~3,500 rpm (rotations per minute) motor, featuring built in over-temperature protection and overload protection with auto-resets, and dry-run protection.

The submersible well pump supplying water shall be the single-phase 0.5 HP 4-inch diameter, multi-stage, well pump with 1.25-inch discharge line, manufactured by Grundfos, model # SP16S 05-5; or approved equal.

The pumps shall each be provided with a dedicated master control switch governed by control wire(s) within conduit(s) routed to their respective destinations, as described below and shown in the Design Documents, where a NEC/NEMA rated, manual, wall-mounted on/off switch with guard, cover, and lock, can be installed and conveniently operated. If switch is exterior mounted, it shall comply with the “Electrical enclosures and junction/pull boxes” specification herein. The waterproof continuous conduit shall comply with the “PVC electrical conduit” specification herein. Wire gauge to comply with pump vendor recommendations and shall supply the voltage necessary for pump activation over the anticipated distances, consult provided pump specifications. Control wires shall comply with the specifications for “Copper conductor wire” herein.

The “master control switch” for the pump within the camp rain catchment tank shall be located at the electrical connection on the adjacent shed as shown in the Design Documents.

The “master control switch” for the pump within the pretreatment tank shall be located at the in the water treatment shed, as shown in the Design Documents.

In addition to a master control switch, the pump shall have an automated float activation system with control wires routed within conduits as needed to create activation logic and desired runtime routine as described by the “Float and control wire”, “Camp rain catchment”, and “Pretreatment tank” specifications below.

Stillwater presumes all components will be installed in accordance with the governing vendor manuals. The Contractor shall successfully conduct operational and functional pump system tests in accordance with the vendor recommendations and manuals.

Performance data, curves, and cutsheets are provided for equivalence in the Appendix to these Specifications

Camp rain catchment pump configuration:

The pump unit shall lower down into the tank directly by the 1.25-inch discharge line, it will be submerged in the tank and draw water directly. The 1.25-inch diameter discharge line from the pump will extend directly from the tank and route water into the top of the highest rainwater catchment tank. There is anticipated to be ~150 feet of TDH along this pumping route, with no

pressure criteria at the discharge outlet in the top of the highest tank. An operable and convenient flow control valve shall be included in this piping run and is required to limit the discharge rate during pump startup procedures.

Pretreatment tank pump configuration:

The pump unit shall lower down into the tank directly by the 1.25-inch discharge line, it will be submerged in the tank and draw water directly. The 1.25-inch diameter discharge line from the pump will extend directly from the tank into the inlet of a water treatment system; this configuration does not gain appreciable elevation, and the pump rate is governed by the back-pressure of the existing treatment system to be attached. The indicated multi-stage pump has a wide range of pressures where desirable flow rates and high efficiency occur; review the pump specifications herein when considering the adequacy and compatibility of this pump to the existing treatment system and the pressure necessary for the existing treatment system to function.

### **10.8 Irrigation Pump Intake Screen**

The intake screen installed on the irrigation pump suction line in the pond shall be Pump-rite model MM-L30 or equivalent.

### **10.9 Floats and Control Wire**

As indicated within the pump specifications above, this portion of the specification will provide the control wire routing and desired automation logic to be governed by a system of floats controlling pump activation.

Control wires shall be within conduits routed to the location described in detail below, and as shown in the Design Documents. The waterproof continuous conduit shall comply with the “PVC electrical conduit” specification herein. The cables and conductors used to govern pump activation shall be consistent with the vendor supplied installation and maintenance manual. Wire gauge to comply with pump vendor recommendations and shall supply the voltage necessary for pump activation over the anticipated distances, consult provided pump specifications. Control wires shall comply with the specifications for “Copper conductor wire” herein.

In addition to the specifications above, the pumps shall have a logical on/off routine governed by floats strategically placed and arranged to automate the diversion and pumping routines as desired and described herein.

#### **10.9.1 Streeter diversion pump float configuration and function**

In addition to the dedicated “Master control switch” specification for each pump above, the Streeter diversion, to include both proposed pumps within the wet well, shall have a mutual shared dual-float activation system with control wires routed ~600 feet up to the general tank pad area within conduits as needed to create the same activation logic and desired runtime routine within both pumps as follows:

1. The pumps (both) shall only operate if the water level within the wet well housing is at the elevation indicated within the Design Documents. Both pumps are equipped with dry-run protection, and the lower limit of operation for both pumps within the wet well shall be governed by a dedicated float set to the desired water elevation in the Design Documents; this water surface elevation should also ensure that the entire pump body is submerged, so that the pumps will not run unless they are fully submerged.

When this baseline submergence condition is satisfied, then the additional subsequent flow control logic described below will be responsible for physically turning the pumps on and off.

2. The pumps shall also de-activate when the top tank reaches high-level; therefore, there needs to be control wire from the float in the top of the highest tank to the pumps.

Floats shall be a narrow-angle type control switch to accurately monitor high (normally open) or low (normally closed) liquid level conditions in the water tanks or wet well. The floats shall at a minimum: have a housing constructed of high-impact, corrosion resistance polypropylene, measuring no less than ~2.75-inches in diameter and ~5” long, and have a visually clear external indicator (float color or banding) to maintain float system; with a maximum submergence pressure rating of ~13psi (~30ft). Floats within these specifications shall be narrow-angle type control switch manufactured by SJE Rhombus, Signal Master, with models numbers consistent with the available “Normally Open”, “Normally closed”, and “Single pole double Throw” models, with chosen default function as appropriate to suit each specific float application described herein; or approved equivalent.

So long as there is consistency in control wire specification between the float vendor and the pump vendor, then the compatible control wire shall be adequate to carry the maximum anticipated load of the control float signals, per vendor recommendations, to be a minimum size of 18 gauge, with 2 copper conductors (UL listed and CSA certified), “portable service cord” type of SJOW, water and oil resistant jacketed Chlorinated Polyethylene (CPE) wire. The cable is flexible and has oil-resistant jacket.

All components shall be UL listed, CSA Certified, and backed by a five-year limited warranty.

### **10.9.2 Camp rain catchment pump float configuration and function**

In addition to the dedicated “Master control switch” specification for each pump above, camp rain catchment tank shall have a dual-float activation system with control wires within the rainwater catchment tank. The pump shall be turned on when the tank is near full and shut off when the tank is near empty.

Floats shall be a narrow-angle type control switch to accurately monitor high (normally open) or low (normally closed) liquid level conditions in the water tanks or wet well. The floats shall at a minimum: have a housing constructed of high-impact, corrosion resistance polypropylene, measuring no less than ~2.75-inches in diameter and ~5” long, and have a visually clear external indicator (float color or banding) to maintain float system; with a maximum submergence pressure rating of ~13psi (~30ft). Floats within these specifications shall be narrow-angle type control switch manufactured by SJE Rhombus, Signal Master, with models numbers consistent with the available “Normally Open”, “Normally closed”, and “Single pole double Throw” models, with chosen default function as appropriate to suit each specific float application described herein; or approved equivalent.

So long as there is consistency in control wire specification between the float vendor and the pump vendor, then the compatible control wire shall be adequate to carry the maximum anticipated load of the control float signals, per vendor recommendations, to be a minimum size of 18 gauge, with 2 copper conductors (UL listed and CSA certified), “portable service cord” type of SJOW, water and oil resistant jacketed Chlorinated Polyethylene (CPE) wire. The cable is flexible and has oil-resistant jacket.

All components shall be UL listed, CSA Certified, and backed by a five-year limited warranty.

### **10.9.3 Pretreatment tank pump float configuration and function**

In addition to the dedicated “Master control switch” specification for each pump above, the pretreatment tank shall have a dual-float activation system with control wires routed approximately 200 ft to the existing “treated water” tanks within conduits as needed to create the activation logic and desired runtime routine as follows. The pump shall be turned on when the existing “treated water tanks” reach half full and shall be turned off when they reach near full. The Contractor shall coordinate with the Owner’s water treatment facility operator to ensure proper functionality of these floats and treatment system.

Floats shall be a narrow-angle type control switch to accurately monitor high (normally open) or low (normally closed) liquid level conditions in the water tanks or wet well. The floats shall at a minimum: have a housing constructed of high-impact, corrosion resistance polypropylene, measuring no less than ~2.75-inches in diameter and ~5” long, and have a visually clear external indicator (float color or banding) to maintain float system; with a maximum submergence pressure rating of ~13psi (~30ft). Floats within these specifications shall be narrow-angle type control switch manufactured by SJE Rhombus, Signal Master, with models numbers consistent with the available “Normally Open”, “Normally closed”, and “Single pole double Throw” models, with chosen default function as appropriate to suit each specific float application described herein; or approved equivalent.

So long as there is consistency in control wire specification between the float vendor and the pump vendor, then the compatible control wire shall be adequate to carry the maximum anticipated load of the control float signals, per vendor recommendations, to be a minimum size

of 18 gauge, with 2 copper conductors (UL listed and CSA certified), “portable service cord” type of SJOW, water and oil resistant jacketed Chlorinated Polyethylene (CPE) wire. The cable is flexible and has oil-resistant jacket.

All components shall be UL listed, CSA Certified, and backed by a five-year limited warranty.

## **11 WATER TANKS**

### **11.1 Polyethylene upright water tanks**

Polyethylene upright water storage tanks (HDPE/XLPE plastic type water tanks) shall comply with the governing and most current revision of standard specification ASTM D 1998.

Polyethylene water tanks shall be sized, positioned, and installed in the configuration shown on the Design Documents, to include one 500 gal holding tank as a component of the camp rain catchment system and a second 5000 gal tank adjacent to the new drinking water treatment shed to provide pre-treatment.

### **11.2 Potable Rain Catchment Tanks**

All buildings, structures, and associated electrical and plumbing systems within these specifications shall comply with the applicable, relevant and governing current and mandated California Building Standards Code (California Code of Regulations, Title 24); herein referred to as the California Building Code (CBC). This California Administrative Code contains administrative regulations of the California Building Standards Commission and administrative regulations of all state agencies that implement or enforce building standards.

This section includes all components associated with the fabrication, installation and long-term stability of the potable rain catchment water tanks and their associated foundations, roofs, and affixed/embedded service piping and pumping systems.

The general intent of this specification is to provide guidance to the Contractor and enlist their knowledge and expertise to recommend a compliant rain catchment and storage system that provides the desired operational criteria. This specification generally assumes a potable liner within a bolted steel water tank, with a stainless steel rain catchment roof and integral gutter screen, and anchored to a cast-in-place reinforced concrete footing beam.

Should the Contractor have a more economical and efficient configuration available than that assumed herein, this specification can be revised to reflect that proposed configuration, so long as the following system criteria are met:

- The overall storage capacity shall be at least 810,000 gallons,
- The total planview catchment area for interception of direct precipitation shall not be less than 10,208 sq ft,
- The overall tank height shall be limited to 11.5 ft,
- The tanks need water level indicators that provide observable indication of stored volume for the purposes for recordation and permit compliance, and
- Compliance with all indicated conditions and specifications below and herein.

All elements of the tanks, piping, catchment roof, and liner, shall be new and unused, of the type, class, and size specified and as shown in the Design Documents. All materials in contact with potable water shall comply with the relevant portions of the CBC plumbing code and all other applicable Local, State, and Federal health and safety regulations and mandates, including those specially related to rain catchment systems and storage.

Structures within this specification shall comply with the applicable governing requirements for resistance of lateral forces, connection of force members and supports, and anchorage of structural walls as set forth within the current edition of the American Society of Civil Engineers' and Structural Engineering Institute's manual for Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE-07).

The minimum serviceability requirements of structural systems, and members thereof, shall be designed under service loads to have adequate stiffness to limit deflections, lateral drift, vibration, or any other deformations that adversely affect the intended use and performance.

All structures herein shall be designed and comply with the applicable portions of the current edition of ASCE-07 (to include at least: general serviceability, seismic design, and wind design). Structures (buildings, non-building structures, and/or water tanks), and all parts thereof, shall be designed and constructed with the adequate strength and stiffness to provide structural stability, protect nonstructural components and systems, and meet the minimum serviceability requirements.

All structures shall be provided with a continuous load path and shall have a complete lateral force-resisting system with adequate strength to resist anticipated forces associated with the anticipated seismic and earthquake loading, as developed and defined within ASCE-07.

All members of the structural system shall be connected to their supporting members; structural walls shall be anchored to diaphragms and supports. The effects on the structure and its components caused by the application of the anticipated live and dead loads and the induced subsequent forces, shall be taken and combined with the effects of other loads as governed within the applicable section of the current ASCE 07.

In accordance with ASCE 07, dead loads anticipated for application shall consist of the weight of all materials of construction incorporated into the building including, but limited to, walls, floors, roofs, ceilings, claddings, finishes, and other similar fixed equipment or structure. These dead loads shall consider inclusion of the site specific recommended credible snow load for the region.

In accordance with ASCE 07, live loads anticipated for application shall consist of the weight of all moving and dynamic loads applied to structural systems and diaphragms; including those induced during live loading scenarios (maintenance/ occupancy), and variable, site-specific, seismic and wind loading scenarios and combinations as specified within ASCE-07.

Structures herein shall consider earthquake ground motion in their design. Every structure and portion thereof, including nonstructural components and critical electrical and plumbing components essential to health and safety, shall be designed and constructed to resist the effects of earthquake motions as developed and prescribed within the seismic requirements of ASCE 07. Site specific seismic design parameters necessary for application of ASCE-07 can be found within the associated soils or geotechnical report; by association and inclusion, structures herein shall comply with and observe the recommendations within the soils or geotechnical report as governing and inherent in achieving the overall stability anticipated by all other applied analytical methods thereafter.

Stillwater Sciences presumes the consensus standards and other reference documents within the CBC and ASCE-07, such that they shall be considered part of this specification.

The following submittals shall be provided to the Engineer for all materials herein, at the earliest date possible after receipt of the Notice to Proceed and prior to delivery to the project site:

- Product Data demonstrating conformance with the Design Documents.
- Shop Drawings detailing fabrication, layout, quantities, sizes, and materials.
- Manuals for installation and maintenance.

## 12 MISCELLANEOUS PROJECT MATERIALS

### 12.1 Reinforced Polyethylene Pond Liner

The standards relevant to impermeable membrane (pond liner) material and installation within the Design Documents shall, at a minimum, comply with the following specifications, unless otherwise exempted. The indicated pond liner within the Design Documents shall be BTL-40 double scrim RPE, as manufactured by BTL Liners and Geomembrane systems, or approved equal, subject to the following conditions and criteria:

- The pond liner material shall: be a black double scrim Reinforced Polyethylene (RPE); with a 16x16 stand count per inch; a minimum thickness 40mil (+/- 10%) in accordance with ASTM D1777; have a minimum weight of 18.5 oz./sq.yd. (+/- 5%) in accordance with ASTM D751; have a coating of at least 2.5mil thickness on each side (+/- 5%); and have a maximum Carbon Black Content of 3.1% in accordance with ASTM D4218.
- The maximum Moisture Vapor Transmission Rate (MVTR) shall not be greater than 0.31 g/m<sup>2</sup> -or- 24hr (0.04 perms) in accordance with ASTM E96; and shall have a maximum permeability less than 2.65 x 10<sup>-12</sup> cm/sec in accordance with ASTM D4491.
- The dimensional stability of the liner shall not exceed 3.8% and 1.8% in the longitudinal and transverse directions in accordance with ASTM D1204.
- The minimum tensile and tear strength shall have a minimum of the following:
  - A tensile strength of at least 680lbs in the longitudinal direction, and 680lbs in the transverse direction, via the “Grab Method” in accordance with ASTM D5034;
  - A tensile strength of at least 460lbs in the longitudinal direction, and 460lbs in the transverse direction, via the “Strip Method” in accordance with ASTM D5034;
  - A “Tear strength” of at least 140lbs in the longitudinal direction, and 140lbs in the transverse direction, via the “Tongue Method” in accordance with ASTM D5884.
- The liner shall have a minimum bursting strength of:
  - 1,300psi in accordance with ASTM D3786;
  - a minimum hydrostatic resistance of 685psi in accordance with ASTM D751;
  - A minimum puncture resistance of 350lbs in accordance with ASTM D4833.
- The liner shall provide resistance to puncture (bearing) in accordance with the California bearing ratio (CBR) static resistance determination of 2,356lbs (10,461 N) in accordance with ASTM D6241.
- The low-temperature “Cold Crack” shall not be greater than -85 deg. F. in accordance with ASTM D2136.
- The liner shall have a High Pressure (HP) Oxidative Induction Time (OIT) of at least 3,048 minutes in accordance with ASTM D5885, and the UV resistance of the liner shall not reduce its strength by more than 10%, after 2,000 hours of exposure in accordance with ASTM G-154

## 12.2 Non-Woven Geotextiles

A non-woven Geotextile separator fabric such as specified in the table below or an approved equal shall be used. Proposed equals must be submitted to the Engineer at least 30 days before bid date to be considered for approval.

Product shall be nonwoven needle-punched geotextile, or approved equal, manufactured for subsurface drainage applications, made from polyolefins or polyesters; complying with AASHTO M 288 and the following, measured per test methods referenced:

<b>Property</b>	<b>Test</b>	<b>Unit</b>	<b>Min. Average Value</b>
Grab Tensile Strength	ASTM D 4632	lbs	380
Grab Tensile Elongation	ASTM D 4632	%	50
Trapezoid Tear Strength	ASTM D 4533	lbs	140
CBR Puncture Strength	ASTM D 6241	lbs	1025
Permittivity	ASTM D 4491	sec-1	0.7
Flow Rate	ASTM D 4491	gal/min/ft <sup>2</sup>	50
UV Resistance	ASTM D 4355	%	70
<b>Property</b>	<b>Test</b>	<b>Unit</b>	<b>Maximum Value</b>
Apparent Opening Size	ASTM D 4751	U.S. Sieve	100

Stillwater Sciences to verify the absence of tears or any lack of coverage in areas to receive geotextile fabric prior to and backfill.

## **12.3 Concrete Vaults**

### **12.3.1 General**

Reinforced precast concrete vaults, rings, culverts, manholes, boxes, and similar items shall comply with the specifications herein, as adopted from and in consistency with, the relevant guidance of American Concrete Institute (ACI), American Standard Test Methods (ASTM), American Welding Society (AWS), and the National Precast Concrete Association (NCPA) specification and standards, to include, but not be limited to the most current and applicant revision of the following:

- ACI 318, ACI PRC 211.1, ACI 213, ACI 237, ACI 305, ACI 306, and ACI 308;
- ASTM A: 36, 184, 615, 706, 767, 775, 884, 1064, 1094; ASTM C: 31, 33, 39, 94, 138, 143, 150, 171, 173, 192, 231, 260, 309, 330, 494, 497, 595, 618, 979, 989, 1064, 1107, 1240, 1582, 1602, 1603, 1610, 1611, 1621, 1712, 1758, 1778;
- AWS: D1.1, D1.4, and
- NPCA Quality Control Manual for Precast Concrete Plants.

### **12.3.2 Submittals**

Submit shop drawings showing compliance with the construction specifications herein, prior to fabrication and procurement for review and approval by Stillwater Sciences; materials procured before receipt of this approval and concurrence are the responsibility of the Contractor.

### **12.3.3 Round vaults**

Round vaults as described in the Design Documents shall be constructed with precast concrete well casings with height, diameter, and installed configuration shown on the Design Documents from Hilfiker Pipe Company or approved equivalent. Vaults shall feature integral bases to exclude water, gaskets, ladder access if deeper than 4 feet, and a protective lockable lid to prevent entry.

### **12.3.4 Rectangular vault**

The rectangular vault for the Streeter Creek diversion intake as described in the design documents shall be constructed with precast concrete with height, length, width, and installed configuration shown on the Design Documents from Hilfiker Pipe Company or an approved equivalent.

## **12.4 Fish Screen**

### **12.4.1 General**

Provide and install banded stainless steel fish screen panel as shown and specified, in accordance with the requirements of the Design Documents.

### **12.4.2 Submittals**

- Submit shop drawings showing compliance with the specifications including tolerances, prior to manufacturing screens.
- Submit shop drawings showing support design and fastening approach to the grated concrete vault.

### **12.4.3 Product**

Fish screen shall be manufactured by an ISO 9000 Certified company, fabricated by ASME Section IX Certified welders and the manufacture shall provide evidence of experience in having supplied five similar designs which have been in successful service for at least five years.

Fish screens should be provided by Hendrick Screen Company, P.O. Box 22075, Owensboro, Kentucky 42304-2075, (270) 685-5138, fax (270) 685-1729, or approve equivalent.

Fish screens shall be all welded construction fabricated from Type 304 or 316 stainless steel. The screen surface shall be of smooth wire or bar of a wedge wire shape with inwardly enlarging openings to minimize the likelihood of debris entrapment. Screen wedge wires shall be continuous over the length or width of each panel as specified herein. Splices are not allowed unless specifically approved by Stillwater Sciences. Wires shall be welded to the stainless steel support bars sufficient to withstand the specified loading conditions, tolerances and deflection. The wires, supports, backing bars, and banding shall be welded to form a single unit as shown on the drawings. Welds shall be smooth, without burrs or irregularities.

Wire and Slot: The surface wire shall be Hendrick Screen Co. No. 69 Wedge wire or approved equivalent. The screen slot opening shall be .069 inches. The open area for this slot opening shall be 50 %. Slot size shall be controlled and continuously monitored during manufacture. The wire orientation shall be vertical or horizontal.

Loading: The screen panels shall be designed for Ultimate Load of 124 psf (2 ft. hydraulic differential) and a Working Load of 62 psf (1.0 ft. hydraulic differential). The maximum deflection from under uniform Working Load shall not exceed 1/4-inch. The maximum allowable stress shall not exceed 80% of Yield in any member under Ultimate Loads.

Tolerances: Screen shall be designed and fabricated so as to ensure that the completed fish panels are within the tolerances specified herein while under a no load condition: The screen panel shall be flat with horizontal to within 1/8 inch plus or minus. The diagonal dimensions of the screen panels shall be within 1/4 inch plus or minus. Panel length and width shall be within 1/8 inch plus or minus.

## **12.5 Coanda Box**

Provide and install Coanda Box as shown and specified, in accordance with the requirements of the Design Documents. Coanda Box should be provided by Elgin Separation Solutions, (614) 524-4588, or approve equivalent.

Coanda box shall be all welded Type 304 or 316 stainless steel with mounting tabs and removeable screen. Welds shall be smooth, without burrs or irregularities. Coanda box should be model CBS0.5 or approved equivalent.

## **12.6 New Pump and Treatment Shed**

Small sheds shall be constructed to: 1) house the irrigation pump system adjacent to the pond and associated electrical components and controls/electrical components for the groundwater pump; and 2) house the relocated drinking water treatment facility. The contractor is responsible for all materials and labor associated with shed construction.

The sheds shall have a minimum interior dimensions of 4 ft x 4 ft and have weather tight roof, walls, and door, as well as sufficient thermal and vapor retardation to maintain operational temperatures and humidity for the pump and treatment facility. Contractor shall submit shop drawings to Stillwater Sciences showing proposed construction approach including: 1) building materials and equipment layout within the shed for approval prior to construction.

Proposed pumps are included in Section 10.7.

## **12.7 Water Treatment Facility Relocation**

The existing water treatment facility located adjacent to the Streeter Creek diversion will be moved to a location near the rainwater catchment tank farm. The contractor is responsible for all materials and labor associated with treatment facility relocation including construction of a new shed per the specifications above. This existing shed will be reused for Streeter Creek pump controls. Contractor shall work with the Owner to ensure that the new treatment facility is functioning properly upon completion of the relocation.

## **12.8 Gutters and Other Rainwater Catchment Appurtenances**

This section includes components used for the rainwater catchment system at the Bid Top pavilion and storage tanks. All materials associated with the potable water system shall comply with NSF 61 and NSF 372 (max lead standards). All pipes, fittings, fixtures, solder, and flux shall meet the 0.25% maximum lead content rules for all wetted components. All rainwater catchment components shall be new and unused, stainless steel, and of the type and size specified.

Rainwater catchment gutters are to be placed on the Big Top Pavilion and shed. All downspouts are to have a Leafater Downspout Filter. Gutters for the Big Top Pavilion are to be Big Top brand or approved equivalent, manufactured to fit the pavilion. Other gutters for the rainwater catchment system and corresponding components are per the design of the contractor, meeting material standards listed above. Final design of rainwater catchment is dependent on approval from the Engineer.

The following submittals shall be provided to the Engineer for all materials herein, at the earliest date possible after receipt of the Notice to Proceed and prior to delivery to the project site:

- Product Data.
- Shop Drawings detailing fabrication, layout, quantities, sizes, and materials.
- Manuals for installation and maintenance.

## **12.9 Permanent Pond Fencing**

Permanent 6 ft high wildlife fencing will be installed around the pond. The Contractor is responsible for locating all buried utilities in the project area. Ensure all fencing materials installed are durable and of high quality, and the type and design of the fence installed meets the management objectives

Fencing material shall be 6 ft high woven no-climb horse fence with 2" x 4" holes, Class 1 hot dipped galvanized steel, and wire gauge as follows: Top 9.75, middle 12.5, bottom 9.75.

Fence posts shall be standard 1-3/4 in x 3-1/2 in x 8 ft length standard green T-Posts with anchor plate. Every 8<sup>th</sup> post shall be comprised of a 8 ft high 4x4 or steel post embedded in concrete.

Fence corners shall be constructed with three 8 ft length concrete embedded braced posts comprised of either pressure treated 4x4 wood or 3 inch diameter steel posts. One vehicle gate shall be installed with similar height and material as the rest of the fence.

## 13 SITE DEWATERING AND AQUATIC SPECIES RELOCATION

### 13.1 General

The work site shall be dewatered, to the Engineer's or Geologist's satisfaction, to provide working conditions free of detrimental water, prior to the start of any construction. The amount of flow in the project area may fluctuate. This variance can be attributed to, but not limited to, storms, domestic runoff, irrigation practices upstream, etc. Although surface flow is not expected in the creek reach during construction, groundwater may be encountered.

The Contractor shall develop and submit a dewatering plan for dewatering the project site, even if the creek is dry, in the event of encountering groundwater, rain, other upstream discharge to the creek. The dewatering plan shall be approved by the Engineer or Geologist prior to beginning work.

The Contractor shall maintain the work site in a dewatered condition. No work shall begin until the dewatering system has been installed and such installation has been approved by the Engineer or Geologist.

The Contractor shall not lay claim against the Project Proponent for damages by surface and/or groundwater flows to their work, property, or materials. The Contractor shall comply with all applicable laws, statutes, and permit provisions with regards to their dewatering system.

The dewatering system shall be maintained by the contractor until all construction is completed.

The dewatering system shall not be removed until authorized by the Engineer or Geologist.

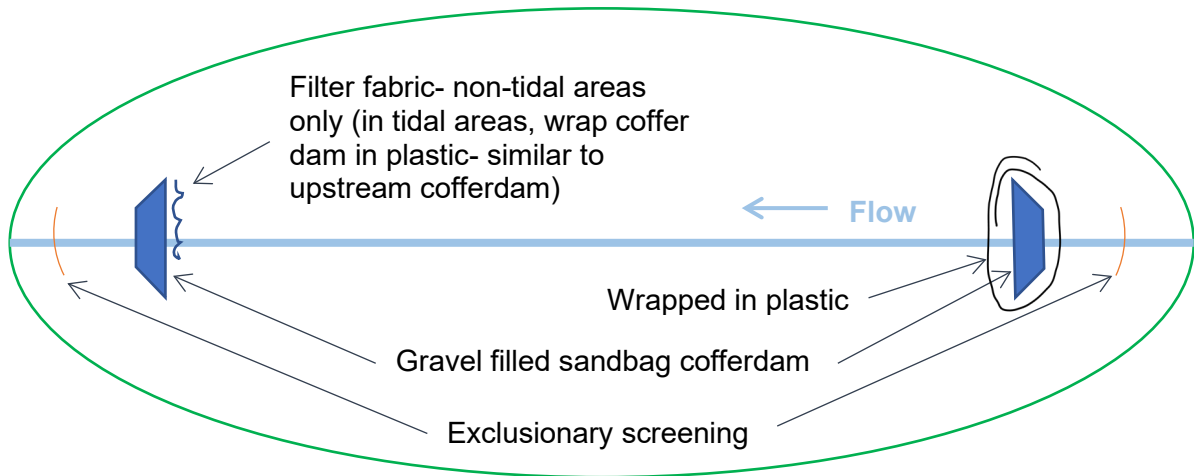
Although surface flow in the creek reach is not expected during construction, if it is encountered, site dewatering work shall preferentially be performed on one reach at a time to ensure adequate time to thoroughly relocate the aquatic species within each project reach, dewater the individual reach and perform project construction and/or remove sediment, per the Design Plans, thereby creating a less significant impact to the overall length of the reach at any one time. Aquatic species removal will be conducted by a third party in coordination with construction timing and dewatering efforts. An approved, qualified biologist from third party shall coordinate timing on when to begin dewatering and sediment removal within each reach as each reach is isolated, and species sufficiently removed and relocated prior to starting work in the next reach.

Dewatering materials shall be supplied by the Contractor. Aquatic species removal, including exclusion screens, shall be supplied by third party biologists.

The dewatering process typically includes the following steps (see figure below):

- Install exclusionary screening across channel upstream of location for upper cofferdam.
- Install exclusionary screening across channel downstream of location for lower cofferdam in this reach.
- Biologists seine low-flow channel and any pools between exclusionary screens to capture and relocate native freshwater fish and shall continue until as many fish as possible have been captured and relocated from the reach. Portable pumps shall be used as needed to complete dewatering of any pools.

- When biologists have completed fish relocation efforts, they will authorize installation of the cofferdams, to be installed just inside the exclusionary screening at the upstream and downstream limits of the reach.
- After cofferdams have been installed, further dewatering will occur (if necessary).
- After dewatering, construction and/or sediment removal may proceed.
- Removal of cofferdams and exclusionary screening.
- Complete any grading and install erosion control, and plantings as needed.



### 13.2 Project Biologist

To avoid conflicts the Contractor’s work shall be coordinated with any work performed by third party biologists associated with fish relocation activities. Fish relocation activities will be completed by a qualified fish biologist, experienced with fish capture and handling.

A CDFW-approved “Qualified Biologist” will direct the native fish capture and relocation efforts, along with a team of their and the Engineer’s or Geologist’s choosing. Biologists shall have appropriate permits from CDFW (SC-806) and NMFS (1045-1) to capture and handle listed salmonids and other aquatic species, and shall, ideally, have experience performing this task in multiple other similar reaches. Biologists shall follow CDFW and NMFS guidelines and notify these agencies at least one week prior to beginning of fish capture activities.

### 13.3 Exclusionary Screening

Prior to fish removal, installing cofferdams, and dewatering, exclusionary screens shall be securely installed at the downstream and upstream work limits as shown on the Design Plans. Exclusionary netting shall be a fine mesh block net placed across the full wetted channel of the creeks within each individual reach to assist in isolating individual areas for more thorough fish capture by the Biologist.

All fish screens, including exclusionary netting, shall have openings no larger than 3/32 inch in diameter (or diagonally if rectangular) and shall comply with CDFW/NMFS screening criteria for

salmonids. When used to screen intakes on portable pumps, the screen shall be in the form of a basket of sufficient size to comply with CDFW/NMFS criteria for water velocity across the screen face, in order to not entrain fish and cause them to be impinged against the screen.

Exclusionary screening may also be installed where the biologist determines the downstream limit of fresh-water fish capture should be. In this case, the Biologist will determine an appropriate location for the lower limit of freshwater aquatic species, and exclusionary screening will be placed across the channel in this location. Fish capture and relocation downstream of the limit of active freshwater fish capture will be per the recommendation of the Biologist.

The Biologist shall determine exact locations for exclusionary screening and netting in the field sufficient to minimize the length of creek that will require fish relocation and at the same time that adequately relocate fish that could be impacted by the planned work. The fish capture should begin only when the exclusionary screens and nets are in place for each reach.

### **13.4 Fish Salvage and Relocation**

The Contractor shall coordinate with and provide assistance to the Project Proponent and the qualified project fisheries biologist to relocate any fish occupying the pools remaining throughout the project reach prior to start of work. The Contractor shall contact the Engineer or Geologist a minimum of one week prior to dewatering to arrange the specific day for this work to occur.

The Biologist shall walk through the upstream reaches of the project to identify pools, undercut areas, or other locations where native fish are more likely to be found. The Biologist shall also attempt to verify that native fish smolts appear to have emigrated, so only juveniles are expected. During this walkthrough the Biologist shall also direct the appropriate party to remove overhanging and in-stream vegetation that could interfere with fish removal efforts.

At least one “designated driver” will be constantly transporting buckets and/or tubs of fish to the relocation sites while a crew of “fishers” will assist the biologists in collecting fish with dip nets and seines. Fish will be relocated within 30 minutes of capture or less at the discretion of the Biologist. Designated drivers will handle the buckets/tubs in which fish will be transported carefully in order to avoid sloshing and minimize stress and injury to the relocated aquatic species. During transit, the designated driver will travel slowly and smoothly while another crewmember monitors the containers. After confirming that water temperature in the containers is within 2-3 degrees of ambient stream temperature at the relocation site, the buckets and tubs will be lowered slowly into the pools at the relocation sites, and not dumped. If there is a thermal difference of more than 2–3 degrees, stream water will gradually be mixed with the water in the containers over a few minutes time, to allow the fish to acclimate to the ambient stream water temperature before they are released.

The designated drivers shall use direct routes to the relocation sites to minimize the time that aquatic species will spend in transit. Sites shall, if possible, have easy and short access from the work site, expediting the fish relocation process. All relocation sites should be, if possible, either downstream of the project dewatering boundaries and areas of dewatering impact. Fresh water species shall be relocated to suitable freshwater habitat downstream of the project area. The Biologist shall inspect the sites before fish relocation begins. Fish shall not be relocated to any pools that do not also have good in-stream shelter for the fish (e.g., boulders, undercut ledges, rootwads, vegetation, etc.).

Multiple relocation sites shall be used, where feasible, in order to reduce competition for resources with resident fish and the sites shall be spaced far enough apart to facilitate fish dispersal. The buckets/tubs shall be filled with clean, clear water from the stream near where those fish are removed and shall be continuously aerated during fish capture to ensure dissolved oxygen concentration is near saturation. The buckets/tubs shall be large enough and contain small enough numbers of fish to avoid overcrowding. Steelhead shall be placed in insulated buckets (3-gal., covered bait buckets or in larger insulated coolers) and segregated by size classes and from all other species. To minimize stress and injury to the fish, waterlogged leaves or twigs may be added to the containers to provide shelter (and to reduce sloshing during transport). Toxic vegetation and most other live vegetation shall not be placed in the containers.

Wading gear and all equipment brought to the site shall be sterilized prior to entering the water according to CDFW's Aquatic Invasive Species Disinfection/Decontamination Protocols. Formula 409 disinfectant shall not be used. Gear shall be sterilized again at the end of each workday or before it is used in a different body of water.

Water temperatures shall be monitored with thermometers to ensure that water in the buckets/tubs are at or below water temperatures in the creek where the fish were collected. If necessary, sealed bags of ice may be floated in each container. All fish buckets/tubs will be kept in quiet, still, shaded areas and fish will be held in these containers for a minimal amount of time per the discretion of the Biologist.

Capture nets shall be made of non-abrasive, soft, knotless nylon and the mesh shall be small enough (1/8-3/16<sup>th</sup>-inch) to capture the smallest juveniles or fry encountered. As many as possible of the native fish encountered shall be captured and relocated, although it is not always feasible to capture all of the smallest (<0.5-inch) fry of native species potentially present. The seines, dip nets, crewmembers' hands, and all other materials/equipment used shall be washed with stream water and remain wetted prior to any contact with aquatic species and shall be free of any substances such as hand sanitizer, sunscreen, and insect repellent.

Portable pumps shall be used as needed to lower water surface elevations in isolated pools to increase fish capture efficiency. As water levels are brought down, fish are forced to leave hiding places and move to the center of the channel where they can be captured more easily. Pump intakes shall be screened per NMFS criteria for anadromous salmonids having openings no larger than 3/32 inches in diameter (or diagonally if rectangular). One two-inch portable pump and one three-inch portable pump, or as needed for the project area, shall be on hand to lower water surface elevations in pools during fish relocation. The appropriate size pump shall be selected based on the size of the pool to be dewatered. This water should be pumped downstream of the reach being dewatered as long as it is clean and clear of sediment. Otherwise, it should be pumped and discharged above and beyond the top of bank where it may diffusely infiltrate into the surrounding vegetation and soils.

Captured species shall be identified and counted, except for extremely abundant species, as determined by the Biologist. Non-native species found will be destroyed. All turtles encountered, including Western pond turtles, will be identified, measured and sexed by the Biologist prior to relocation.

If any salmonids are found dead or injured, the Biologist will contact CDFW/NMFS immediately by phone to determine if additional protective measures are to be taken. Mortalities will be retained in a sealed plastic bag with a label indicating the date and location of collection and fork

length. They will be frozen as soon as possible and kept frozen until CDFW/NMFS gives specific instructions.

### **13.5 Installation of Cofferdams**

Cofferdams shall be constructed upstream and downstream of the work area to bypass all flow from upstream of the upstream cofferdam to downstream of the downstream cofferdam. The cofferdams can be constructed of clean river gravel or sandbags. Clean river gravel may be left by grading into natural bed elevation following construction, if the Engineer or Geologist determines substrate size distribution is suitable, whereas sandbags (and sheet plastic) must be removed.

As each reach has been approved by the Biologist for completion of fish relocation, the Biologist shall authorize the crews to install the cofferdams and dewater as necessary. With the approval of the Biologist, once cofferdams and dewatering has occurred for each reach at a time, construction can begin.

The Biologist and team will monitor the project site throughout cofferdam installation and dewatering. The upstream cofferdam for each reach shall be installed first, then the lower cofferdam shall be installed. The Engineer or Geologist shall determine if bypass pumping from upstream of the upper cofferdam around the reach is necessary or if construction and/or sediment removal within each reach can be completed before significant ponding above the upper cofferdam occurs. Dewatering shall begin only after authorized by the Biologist.

The upstream cofferdams for each reach shall be constructed by excavating the top portion of pervious gravels from the creek bed, placing a large sheet of plastic sheeting down into the excavated bed, backfilling across the plastic sheeting in the creek channel with gravel filled sand bags, and then wrapping the gravel bag cofferdam with the plastic sheeting. Downstream cofferdams not located in tidal areas shall also be constructed from gravel filled sandbags, and shall be placed on top of the existing creek channel, and shall have geotextile fabric wrapped over the upstream face of the dam as a preventative measure to help filter any suspended sediment from flowing downstream.

Downstream cofferdams located in tidal areas shall be constructed similar to upstream cofferdams, with plastic sheeting, so as to keep the tidal water out of the reaches during dewatering and construction activities. The downstream cofferdam shall be installed at a very low tide to minimize the amount of tidal water to be pumped out of the project area.

### **13.6 Water Bypass**

Water bypass shall be conducted using a gravity feed or pumped bypass line as recommended by the Design Plans. Bypass pipe diameter shall be sized to accommodate, at a minimum, twice the summer base flow. The Contractor is required to maintain free flowing water bypass at all times during the project including nighttime and weekends. Bypass water shall be discharged to the channel in a location approved by the Engineer or Geologist and may require energy dissipation at the outlet, which shall be installed and maintained at the Contractor's expense.

Existing stream flow and or existing pool water levels upstream of the project work area and downstream of the project work area shall be maintained at or near normal summer low flows during construction. Pumping rates should be monitored to ensure water levels upstream are not being inadvertently lowered by excessive pumping.

### **13.7 Dewatering**

Pumps shall be placed in flat areas, well away from the wetted stream channel. Pumps shall be secured in place (staked or tied back) to prevent movement caused by vibration. Pumps shall be refueled in an area that is well away from the stream channel and be placed on top of fuel absorbent mats. Spill control kits shall be available at the project site at all times and construction personnel trained in the proper spill control procedures. In no case shall turbid, or any contaminated water be discharged directly to any waterway.

Pumped water shall be discharged to a filtration/settling system (i.e., filter fabric, turbidity curtain, or settling basin) downstream of work area to reduce turbidity, or discharged to vegetated upland areas for infiltration, where the water may be absorbed by the ground and not flow back into a stream within the work area. The Contractor is responsible for establishing infiltration or sediment basin locations to be approved by the Stillwater Sciences and the Owner. All sediment collected from dewatering the construction area shall be disposed of off-site by the Contractor to an approved location.

### **13.8 Sediment Removal**

Sediment shall be removed, where called for on the Design Plans, when the water surface is at its lowest level, with minimal surface water flows. To reduce turbidity, sediment removal shall occur only after wet project reaches are dewatered.

### **13.9 Removal of Exclusionary Screen and Cofferdams**

All cofferdams, pumps, screens, gravel filled sandbags, and any other materials shall be removed from the stream upon construction completion as soon as possible and in a manner that will allow flow to resume with the least disturbance to the channel substrate. Cofferdams shall be removed carefully and methodically to prevent erosion and increased turbidity of water flow back into the downstream reach. Cofferdams shall be removed such that surface elevations of water impounded above the cofferdam will not be reduced by a rate greater than one inch per hour. This will minimize the risk of beaching and stranding fish as the water surfaces of areas upstream are lowered.

## 14 PLANTING, REVEGETATION & EROSION CONTROL

### 14.1 General

The Contractor shall furnish all labor, materials, tools, equipment, and incidentals to complete all planting shown on the Design Plans and related work for revegetating any areas disturbed by construction activities and those areas shown on the Design Plans. Planting and revegetation shall be performed by a C-27 licensed landscaping contractor.

The Contractor shall plant native grass seed and live willow stakes as indicated on the Design Plans or as directed by Stillwater Sciences. Plant materials shall be those that have been propagated from local sources only. Native grass seed shall be planted at the site primarily in areas disturbed by equipment access.

All seed shall be in conformance with the California State Seed Law of the Department of Agriculture. Each seed bag shall be delivered to the site sealed and clearly marked as to species, purity, percent germination, dealer's guarantee, and dates of test. In addition, the container shall be labeled to clearly reflect the amount of Pure Live Seed (PLS) contained. Seed shall be purchased from Pacific Coast Seed (<http://www.pcseed.com>) or approved equivalent.

### 14.2 Native Grass Seed

The native erosion control grass seed shall be spread by hand broadcasting methods over all disturbed and/or exposed soil, with the exception of the creek bed. Incorporate the seed uniformly at the specified rates per acre. Provide seed of the latest crop, labeled in accordance with the California Food Agricultural Code with the ingredients per acre as described on the Design Plans.

Seed shall be spread following construction and immediately prior to the first significant rainfall in October of the construction year, or as direct by Stillwater Sciences. Straw mulch should be placed immediately following seeding.

### 14.3 Live Willow Stakes

#### 14.3.1 General

This section applies to the furnishing and planting of Live Willow Stakes during construction of habitat enhancement and bank and channel stabilization features as directed by the project manager and engineer. Willow stakes must have sufficient sunlight and moisture to survive.

#### 14.3.2 Materials

The Contractor shall source the live willow stakes on-site. If an appropriate source is not available on-site, the project manager shall provide a secondary local source, ideally within 10 miles of the project site. Willow stakes shall be 1 to 3 inches in basal diameter by  $\pm$  4 feet long.

#### 14.3.3 Installation

- Willow stakes shall be collected (harvested) and soaked in water a minimum of 12 hours prior to placement, but no earlier than 7 days before placement. Willow stakes can be stored for up to seven (7) days in large water tight bins (trash cans) filled with water and placed in the shade to prevent significant drying of ends.

- The Contractor must give a minimum of 48 hours notice to the Engineer prior to construction of any features that require Live Willow Stakes. Engineer will inspect conditions of willow stakes and ensure they are not desiccated. If Engineer approves Live Willow Stake conditions, the Engineer will direct contractor on installation procedures. Failure to properly store willow stakes and cause desiccation or failure to install properly may require the reconstruction of these features at no additional cost to the Client.
- When staking Large Wood Structures, Live Willow Stakes shall be placed immediately after trenches are excavated so that they are in maximum contact with the underlying soil. Small rocks and soil can then be placed in and around the stakes such that they are generally vertical and shall be trimmed as necessary to have no more than 24” inches sticking above the rock or grade line.
- Willow stakes shall have a minimum of 24” inches of contact with the underlying native material.
- Willow cuttings shall be planted during the placement of all features. WILLOW STAKES SHALL NOT BE PLANTED AFTER FEATURES ARE INSTALLED.
- Minimize damage to cuttings by laying final course or rock by hand placement. If necessary, trim off damaged ends of cuttings and remove and replace damaged stakes at discretion of Engineer at no additional cost to the Client.
- Willow shall be watered until the first significant rainfall of the season to insure survival.

#### **14.4 Straw Mulch**

Rice straw or certified weed free straw mulch shall be used to cover all disturbed soil with a coverage rate of approximately 60 bales per acre.

## **15 INVASIVE SPECIES**

### **15.1 General**

Implementation of this project will be conducted to avoid the spread of aquatic invasive species (AIS), most notably New Zealand mudsnail, quagga mussels, and zebra mussels. Protocols will be used consistent with CDFW (2016) to decontaminate all gear (e.g., waders, boots, etc.) and equipment (e.g., survey rods, excavators, block nets, etc.) prior to entering the project reach to ensure protection from AIS.

Himalayan blackberry (*Rubus armeniacus*) grows in the project area and can re-establish from very small stem and root fragments. Measures should be taken during implementation to avoid spreading this species and introducing them to other areas in the project vicinity.