

# Special Specification 5122

## Water Quality Sand Filtration Pond



### 1. DESCRIPTION

Furnish, construct, and install proposed water quality and detention pond in conformance with Texas Commission on Environmental Quality (TCEQ), including the removal and disposal of accumulated sediment from water quality pond associated with the project.

### 2. MATERIALS

2.1. **General.** Furnish materials in accordance with the details shown on the plans, the requirements of this Item, and the pertinent requirements of the following items:

- Item 100, "Preparing Right of Way"
- Item 110, "Excavation"
- Item 132, "Embankment"
- Item 400, "Excavation and Backfill for Structures"
- Item 402, "Trench Excavation Protection"
- Item 420, "Concrete Substructures"
- Item 423, "Retaining Walls"
- Item 432, "Riprap"
- Item 440, "Reinforcement for Concrete"
- Item 459, "Gabions and Gabion Mattresses"
- Item 464, "Reinforced Concrete Pipe"
- Item 481, "Pipe for Drain"
- Item 556, "Pipe Underdrains."

2.2. **Filtration Bed.**

2.2.1. **Filtration Bed Sand.** Furnish and install filtration sand bed in accordance with the plans meeting the gradation requirements of ASTM C33 Concrete Sand.

2.2.2. **Filtration Bed Gravel.** Furnish and install filtration bed gravel. Provide Grade 2 coarse aggregate in accordance with Section 421.2.6.1., "Course Aggregate."

2.3. **Underdrain.** Furnish and install SCH40 PVC Pipe of the size specified on the plans in accordance with Item 481, "Pipe for Drain."

2.4. **Geotextile Fabric.** Furnish and install Type 1 filter fabric of uniform quality in accordance with DMS-6200, "Filter Fabric."

2.5. **Concrete Splitter Box.** Construct Class B concrete splitter box in accordance with Item 420, "Concrete Substructures" and as shown on the plans.

2.6. **Splitter Box Outlet with Concrete Splash Pad.** Furnish and install Class III reinforced concrete pipe for splitter box outlet in accordance with Item 464, "Reinforced Concrete Pipe" and as shown on the plans.

Construct Class B concrete pad in accordance with Item 420, "Concrete Substructures" and as shown on the plans.

- 2.7. **Clay Liner.** Furnish and install clay liner material in accordance with Table 1.

**Table 1**  
**Clay Material Properties**

Material Property	Requirement	Testing Standard
Min. Liquid Limit	>30	Tex-104-E
Min. Plasticity Index	15	Tex-106-E
Min. Percent Passing #200 Sieve	30%	Tex-110-E
Max. Particle Size	< 1 inch	Tex-110-E
Max. Laboratory Permeability	< 1x10 <sup>-6</sup> mm per second	ASTM D 2434

Provide clay liner material free of organics and debris, such as tree limbs, bark, leaves, trash, or other deleterious material. Limit the maximum clay clod size during liner placement and compaction to approximately 1 in. For each potential source of pond liner material, provide enough material to run the tests listed in the table above. During permeability testing, compact the samples in the laboratory to 95% of maximum dry density as determined by ASTM D698 with moisture content at time of compaction at or above optimum moisture content.

- 2.8. **Gabion Basket Wall.** Construct gabion basket wall for filtration pond inlet and flow spreader in accordance with Item 459, "Gabions and Gabion Mattresses," and as shown on the plans.
- 2.9. **Filtration Basin Outfall.** Furnish and install SCH40 PVC of the pipe size specified on the plans in accordance with Item 481, "Pipe for Drain." Furnish and install concrete riprap in accordance with Item 432, "Riprap."
- 2.10. **Overflow Weir Plate.** Furnish and install weir plate with anchor bolts on the existing overflow spillway as specified on the plans.
- 2.11. **Filtration Pond Outlet PVC Cap.** Furnish and install SCH40 PVC removable solid end cap with a threaded orifice as specified on the plans.
- 2.12. **Dry Stack Rock Wall.** Construct dry stack rock wall as specified on the plans.
- 2.13. **Check Valve.** Furnish and install check valve at filtration pond outlet.

Check valve must be of the controlled swing type. The controlled closing swing check valve must be guaranteed to operate under severe conditions as check valve. The valve must be designed to open smoothly, provide full pipe flow, permit minimum head loss and controlled at a controlled rate of speed for the final predetermined portion of its stroke. All bolts and nuts used in the assembly must be steel, commercial grade.

The valve body must be cast iron ASTM A126-B/ductile iron ASTM a536. The disc arm and chamber level must be of heavy steel construction and keyed to the hinge shaft. The hinge shaft must be of 18-8 stainless steel and of adequate diameter to withstand a complete hydraulic unbalance pressure of 125 psi on the valve disc. Valve closure must be controlled by a single cushioning device mounted on the external side of the valve by way of the interchange of oil to and from an oil reservoir. The use of pressurized air or gas is not permitted. The oil plunger assembly must be rigidly attached to the valve body by shoulder bolts or dowel pins to prevent fretting.

The valve, when closed, must be tight seating by way of resilient replaceable seat against a bronze seat ring in the body.

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### 3. EQUIPMENT

Furnish all equipment necessary to construct water quality sand filtration pond.

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### 4. CONSTRUCTION

**General.** The drawings depict the pond in its final constructed configuration including 6 in of topsoil and sod. Refer to the General Conditions in the Contract Documents for responsibilities relating to submittals.

4.1. **Quality Control Submittals.** Submit shop drawings or product submittal to the Engineer for review of the following items:

- geotextile fabric and
- weir plate with anchor bolts.

4.2. **Embankment.**

4.2.1. **General.** Place embankment in accordance with Item 132, "Embankment."

4.3. **Clay Liner.**

4.3.1. **General.** Provide a compacted clay liner on the bottom of the entire water quality pond with a minimum thickness of 12 in. Place the liner in maximum 6 in. thick lifts in accordance with density control requirements of Sections 4.3.2., "Liner Construction" and 4.3.3., "Liner Field Testing" of this Specification.

Extend the clay liner below and around all concrete ramps, aprons, loose rock riprap and other miscellaneous structures within the sedimentation and filtration pond interior and sides up to an elevation no less than 1 ft. above the water quality elevation of the sediment pond, and not less than 2-1/2 ft. above the top of sand elevation of the filtration basin.

4.3.2. **Liner Construction.** Compact the subgrade to at least 95% of the maximum dry density when tested in accordance with Tex-114-E. For subgrade soil with a plasticity index (PI) of 25 or higher, ensure that the moisture content at time of compaction is not higher than 4% above optimum moisture content. If the subgrade soil has a plasticity index (PI) of less than 25, ensure that the moisture content at the time of compaction is within 3% of optimum moisture content. Remove all loose material from excavated subgrade before clay liner construction.

Construct the clay liner monolithically in the bottom and sides of the pond bays.

Compaction must be in accordance with Item 132, "Embankment." Compact each lift of the clay liner to 95% of the maximum dry density with moisture content at time of compaction at or above optimum before the next lift is placed.

Take measures to avoid cracking or crusting of each lift surface. If cracking or crusting of the lift surface occurs before placement of the next lift, sprinkle the area with water, scarify to a depth below the cracking or crusting, and re-compact as outlined above before the placement of a subsequent lift. During construction, maintain a wet surface on all finished lifts or portions of the liner to prevent drying and cracking of the clay.

Do not construct sections of liner constructed next to a completed section by "butting" the entire thickness of the new liner section next to the completed section. Instead, bench the edge of the complete section of liner at mid-depth for a minimum 12 in. width such that the section being constructed and the completed section are offset in a stair-step fashion without a construction joint through the entire liner thickness.

At the end of each day's operation, thoroughly wet completed lifts or sections of the compacted clay liner to prevent drying and cracking. Rework and retest any areas of the liner which do not meet moisture or density requirements during testing until the constructed liner meets the specification.

Following the completion of the final lift, water the liner regularly until the 6 in. topsoil overlay is in place. Do not allow liner to dry out and form cracks in the liner surface.

## 4.3.3.

**Liner Field Testing.**

Test individual lifts for moisture and density upon completion of the compaction (and before the subsequent lift) using a nuclear density gauge. Backfill the resulting penetration of the driving pin of the density gauge in the material with bentonite powder.

The frequency of testing of the clay liner during construction must be in accordance with Table 2.

**Table 2**  
**Clay Liner Material**

Test	Test Requirement	Testing Frequency	Testing Standard
In Place Nuclear Density	Greater than 95%	1 per 5,000 sf per lift (Min. of 3 per lift)	Tex-115-E
In Place Nuclear Moisture	Greater than optimum	1 per 5,000 sf per lift (Min. of 3 per lift)	Tex-115-E
Liquid Limit	Greater than 30	At 25%, 50%, 75% and 100% of liner construction	Tex-104-E
Plasticity Index	Greater than 15 <sup>1</sup>	At 25%, 50%, 75% and 100% of liner construction	Tex-106-E
% Passing #200 Sieve	Greater than 30%	At 25%, 50%, 75% and 100% of liner construction	Tex-110-E
Maximum Particle Size	Less than 1 in.	At 25%, 50%, 75% and 100% of liner construction	Tex-110-E
Completed Liner Thickness	Surveyed Liner Thickness	At beginning and end of liner construction	Construction Survey
Thickness of Topsoil over Liner	Surveyed Topsoil Thickness	At beginning and end of liner cover construction	Construction Survey

1. The plasticity index (PI) should be within 10 percentage points of the PI determined during lab testing of the proposed liner material.

Determine the as-built thickness of the clay liner and the topsoil protective liner cover by construction survey. Before the placement of any portion of the clay liner, survey the subgrade to establish the pond bottom. Upon completion of the liner and before the placement of any other pond elements, survey the top of the liner to verify the specified thickness of the liner has been achieved and the top of the liner is at the Engineer's specified grades and slopes, within a tolerance of +/- 0.2 ft. Use the same data points for both pre- and post-liner construction surveys and to survey the pond upon completion of the topsoil cover layer and sand bed installation.

## 4.3.4.

**Liner Repair.** Repair any area of the clay liner that becomes damaged during construction by over excavating to at least 1 ft. beyond the extents of the damaged area in all directions. Reconstruct the full depth of the liner in the damaged area using the above specifications.

Between the undamaged and damaged portion of the liner, bench the clay at mid-depth such that the area being repaired and the undisturbed section are offset in stair-step fashion with no construction joint allowed through the full depth of the liner.

Use compaction equipment appropriate to the size of the repair. Test all repaired areas against the project specifications for the moisture and density listed above before liner acceptance. Rework and retest all repairs that do not meet the density and moisture specifications.

## 4.3.5.

**Liner Documentation.** Provide daily test reports for all tests performed and indicate whether the test result is in compliance with the project specifications. The Construction Materials Testing report must include the following:

- date of testing,
- identification of CMT field technician,
- description of the work performed during the day,
- types of equipment used by the Contractor,
- tests performed by the CMT field technician, and
- failed tests or non-compliant areas that require retesting or other corrective action.

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**5. MEASUREMENT**

This Item will be measured by each water quality sand filtration pond constructed.

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**6. PAYMENT**

The work performed and the materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Water Quality Sand Filtration Pond." The price is full compensation for all materials, excavation, embankment, outfall structures, sand and gravel media, clay liner, filter fabric, concrete riprap, weir plate, concrete pads, dry stack rock wall, PVC caps, underdrains, outlet and inlet structures, and construction survey to provide a complete water quality sand filtration pond in accordance with the plans. This price includes all final finishing, and all necessary equipment, labor, tools, and incidentals.