UPDATED ALTERNATIVES ANALYSIS FRAMEWORK FOR PORTLAND GOLF CLUB IRRIGATION POND DREDGING PORTLAND, WASHINGTON COUNTY, OREGON

Prepared for

OREGON DEPARTMENT OF STATE LANDS
775 Summer Street N.E., Suite 100
Salem, Oregon 97301-1279
(DSL Application 63610-RF)

and

U.S. ARMY CORPS OF ENGINEERS
Portland District, Eugene Field Office
211 East 7th Avenue, Suite 105
Eugene, Oregon 97401-2763
(USACE Application NWP 2023-0024)

Prepared by

PORTLAND GOLF COURSE
5900 S.W. Scholls Ferry Road
Portland, Oregon 97225

October 2023 (Updated)

Introduction

On behalf of Portland Golf Club, the following alternative analysis framework supplements Section 7 of PCG's Joint Permit Application (JPA), USACE Application NWP 2023-0024 and DSL Application 63610-RF. This report documents project criteria and alternatives analysis for the proposed Irrigation Pond ("Junor Lake") Sediment Removal-Disposal project located on PGC property in southwest Portland, Washington County, Oregon. Information herein addresses U.S. Army Corps of Engineers' (USACE's) permit program requirements under the National Environmental Policy Act (NEPA) and the Clean Water Act, Section 404(b)(1) guidelines. This analysis also addresses the Department of State Lands' (DSL's) alternatives analysis requirements under OAR 141-085-0550(5)(o). This document supersedes the previous alternatives analysis submitted with the JPA in June of 2023.

Background

Portland Golf Club (PGC, Applicant) is a premier golf course located in eastern Washington County, Oregon located at 5900 S.W. Scholls Ferry Road. PGC was established in 1914, when no roads existed to the property, and the golf course was accessed by the Oregon Electric railroad. PGC's golf course was designed by world-renowned golf course architect, Robert Trent Jones and is highly regarded throughout the golfing world for combining magnificent design with extreme speed. PGC is listed in the National Register of Historic Places by the National Park Service under the National Historic Preservation Act of 1966 to protect PGC as one of America's historic resources.

Over the years, PGC hosted seven Portland Opens, five Portland Classics, the 1969 Alcan Championship, and the 1982 U.S. Senior Open. PGC hosts thousands of golf plays each year as well as local, regional and national tournaments, such as the Western Amateur, Women's Western Open, Oregon Amateur, U.S. Senior Amateur, PGA Championship, Ryder Cup, PNGA Men, PNGA Women, U.S. Women's Amateur Championship, and Fred Meyer Challenge. Such events each bring 100 or more out-of-state amateur and professional golfers to each event who stay locally for lodging, food services, and entertainment.

The PGC property is 147 acres, which is very compact for a modern day golf course. Approximately 95 acres are irrigated and mowed turf, while the remainder of the property consists of a clubhouse, parking lots, maintenance facilities, recreational uses (pool and tennis courts), and natural spaces (such as creeks, forest, and shrub land). The property is a peaceful oasis only minutes from downtown Portland, with two creeks, Woods Creek and Fanno Creek, winding through the golf course, mature tree-lined fairways, manicured greens, wildlife, and floral configurations. PGC offers active open space within the urban environment of the Portland metro area. The PGC property also provides needed floodplain storage when Fanno Creek floods.

Donald Junor, born in Aberdeenshire Scotland in 1889, came to Portland Golf Club in 1920, and at that time he was the most experienced greens keeper (golf professional) on the Pacific Coast. In the 1920s, he dredged a reservoir on the golf course property using horses, which is named " Junor Lake" in his honor. Junor Lake stores water for irrigation, which water is essential to PGC's operations, but the lake is much more than an irrigation reservoir. Junor Lake is essential to PGC's operations (in-ground water reservoir), as well as a golfing hazard for 2 fairways, and open water feature that attracts waterfowl and small mammals that inhabit nearby forest and open spaces, contributing to the overall design, function, and enjoyment of the property.

Project Overview

Junor Lake is 1.77 acres, receives year-round flows from Woods Creek, and, in turn, seasonally overflows into Fanno Creek. Fanno Creek bisects the golf course, with half of the fairways to the north (front 9 holes) and other half to the south (mostly back 9 holes). Woods Creek bisects the southern portion of the property, flowing from the east boundary to the Junor Lake, then overflows to Fanno Creek via gate

valves to the northwest and southwest. Fanno Creek flows several miles from the golf course to the southwest and is tributary to the Tualatin River.

Woods Creek watershed extends west and south (almost to Interstate 5 near Capitol Highway). The watershed continues to urbanize with in-fill lots being converted to residences, streets widened for sidewalks, and construction of higher density developments (duplexes, apartments, backyard cottages, etc.). The increased amount of stormwater from the watershed has incised Woods Creek several feet deep both above and within the golf course itself. The resultant sediment primarily originates from the creek banks and channel of Woods Creek, but secondarily comes from dirt washed off roads and dust from roofs and other impervious surfaces in the watershed. The creek banks are now nearly vertical, which is typical of flashy, urban runoff. High intensity rainfall events have very slowly widened and deepened the creek, both onsite and upgradient. Those eroded sediments are carried with flood flows to Junor Lake, and are mostly sequestered in that waterbody. The sediment consists primarily of silt, with lesser amounts of sand, clay, organic debris (leaves, twigs), and inert golf balls.

PGC minimizes erosion potential within the golf course by facilitating infiltration and having very little impervious cover. Additional measures to reduce onsite runoff include continued maintenance of forest and tree corridors that intercept rainfall and facilitate subsurface water movement. PGC also closes a gate valve to prevent sediment-laden water from being deposited in Junor Lake when Fanno Creek carries sediments from rain events. Thus, the loss water storage potential in Junor Lake is due to sediment imported by Woods Creek. Given the urbanizing nature of the Woods Creek watershed, sediment accumulation in Junor Lake is unavoidable.

In 1994, PGC received authorization from DSL and USACE to remove accumulated sediments from Junor Lake, but the attempt was not successful. In particular, the equipment was inadequately sized, and associated labor was only capable of removing a few hundred cubic yards of sediment. See attached photographs at the end of this narrative. The failure of the prior sediment removal only delayed the inevitable need to remove 5,300 cubic yards of sediment.[1] As the accumulated sediment increases in Junor Lake, it reduces water storage capacity, and increases sediment uptake by the golf course's irrigation pump, causing damage to PGC's irrigation system. The sediment accelerates pipe deterioration, lowers water pressure, and shortens pump life. After project completion, PGC plans to seek authorization to remove sediment from Junor Lake on a more regular basis and utilize the same location for sediment bag placement.

Creek restoration and greater sediment trapping from the Woods Creek watershed are beyond the scope of this project. However, PGC is encouraged by regulatory agencies, conservation groups, and neighbors to improve water quality and reduce sediment load in Woods Creek. PGC is supportive of mutually beneficial restoration projects that improve water quality in the Woods Creek watershed. PGC will engage in opportunities to work with Clean Water Services and other entities on such ventures outside of this current project.

Project Purpose and Geographic Area

The **basic purpose** of the proposed project is to maintain the continuing viability of the property as a world-renowned golf course. The **overall/specific purpose** of the project is to maintain Junor Lake by removing and disposing of approximately 5300 cubic yards of accumulated sediment from the reservoir, to provide irrigation water to the golf course while also maintaining the integrity and value of the property for its current purpose and function.

[1] The sediment removed from Junor Lake will include an unknown amount of golf balls that will not be removed by the dredging process. As such, all references to placement of sediment in this alternatives analysis necessarily include the golf balls within the sediment. PGC will address disposal of golf balls with the Oregon Department of Environmental Quality at the appropriate time and based on the permits issued by USACE and DSL in this JPA process.

For the purposes of USACE review, the dredging activity constitutes a 'water dependent activity' because the removal of accumulated sediment occurs only within jurisdictional wetland and waters.

The **geographic area** of the project is the PGC property. The golf course was developed and has remained at its current location for over a century. The purpose of the project is to maintain the continuing viability of the PGC property as a world-renowned golf course, so other properties are not available to meet the purpose of the project. However, to ensure a reasonable range of alternatives are considered, off-site alternatives are included for portions of the overall project.

Project Criteria

The project requires removal of 5300 cubic yards of sediment from Junor Lake and appropriately disposing of the sediment. The sediment will be removed by dredging and then placed nearby in large sediment bags. The project alternatives are evaluated using six project criteria: 1) Site size, 2) Site availability; 3) Logistics; 4) Environmental impacts; 5) Cost; and 6) Other qualitative factors. Project criteria are further defined below:

1. Site Size

The site must provide minimum necessary water storage capacity or supply, and also allow for disposal of the removed sediment.

1a. Water Storage/Supply Size: Will the site provide an adequate supply of water to the golf course?

To meets Applicant's water use needs, project alternatives must have storage capacity of at least 4 acre-feet of water, based on PGC's state-issued water rights.

1b. Sediment Disposal Size: Will the site allow for disposal of the full volume of sediment removed?

Approximately 5300 cubic yards of sediment must be removed from Junor Lake. This sediment volume would fill approximately 90 sediment bags (roughly 60 cubic yards per bag, or 5 dump truck loads per bag equivalent).

2. Site Availability

2a. Water Storage/Supply Availability: Is the site one which can be reasonably obtained, utilized, expanded, converted, or modified to provide an adequate supply of water to the golf course?

PGC holds state-issued water rights to store surface water in Junor Lake from Woods Creek and Fanno Creek, and to use direct flows from Fanno Creek and groundwater. PGC's water rights may be capable of certain modifications, but no new/different water rights will be issued by the State for irrigation use on the property. Additionally, storage water rights cannot be changed to move the location of storage or points of diversion, as described in more detail below. Alternative sources of available water are explored in conjunction or alternatively to PGC's water rights.

2b. Sediment Disposal Availability: Is the site one which can be reasonably obtained, utilized, expanded, converted, or modified to allow for sediment disposal?

Available sediment storage locations must have topography suitable for capturing water seeping from the sediment bags, and returning it to Junor Lake. Capturing the seepage water is required to keep the dredge afloat and keep turbid water from entering Woods Creek and Fanno Creek. Some locations may necessitate excavation and grading to create berms to capture seepage water for reuse. The availability of offsite sediment disposal is also considered.

3. Logistics

3a. Water Use Infrastructure: Will the alternative allow connection and use with the existing water system?

Junor Lake is situated at the confluence of Woods Creek and Fanno Creek. PGC's entire water use system is designed and constructed to utilize Junor Lake as a "bulge in the system" to provide enough volume and pressure to run the sprinkler system. The size of Junor Lake (i.e. water storage volume) allows water flows to recharge the pond daily for nightly irrigation. A lake of smaller capacity will not adequately serve the pumping demand required to irrigate an 18-hole golf course each night during the dry season.

3.b. Construction Ingress/Egress: Will existing roads, bridges, and staging areas allow for the necessary construction?

The process of dredging Junor Lake and pumping sediment into geofabric bags for onsite storage or offsite disposal requires access by heavy construction equipment. Access to PGC is limited, and internal access is too narrow for and not constructed to withstand heavy equipment. Consequently, construction logistics are very limited.

3c. Infrastructure Damage Avoidance: Will the alternative avoid damage to existing infrastructure?

Portions of the PGC property contain infrastructure that can be easily damaged by heavy machinery. Irrigation infrastructure is located throughout the PGC property. Additionally, many of the fairways, tees, and green have subsurface drainage pipe and tiles to facilitate water percolation through the soil. The south edge of the property has storm and sanitary sewers under the Fanno Creek pedestrian and bike trail.

4. Environmental Impact

As explained above, Woods Creek and Fanno Creek dissect the PGC property. In addition, wetlands are located on the property that are listed in the US Fish & Wildlife Services' National Wetland Inventory, as well as in the Local Wetland Inventory. In particular, Wetland A is a 0.72-acre wetland near the south edge of the golf course property; while Wetland B is a partially forested wetland located north of Woods Creek and east of Junor Lake. Wetland C is a very narrow band of emergent wetland encircling Junor Lake. Wildlife utilize the creeks and wetlands and other portions of PGC's property.

4a. Stream Impacts (Quantitative): Will the alternative have impacts to streams?

To dredge Junor Lake, it is necessary to temporarily isolate it from Fanno and Woods Creeks. Less than 15 feet of Woods Creek will be temporarily disturbed for placement of a coffer dam where Woods Creek enters Junor Lake. The creek channel at this location is mostly unvegetated and has a soil substrate. The coffer dam will use plastic sheeting and sand bags to minimize impacts to the creek sidewalls and bottom. The temporary bypass pipe will be secured to 660 feet of the south edge of Junor Lake. After dredging, the coffer dam and pipe bypass will be removed leaving no damage to Woods Creek. No permanent damage will occur to Woods Creek or Junor Lake.

4b. Stream Functions (Qualitative): Will the alternative have impacts to water quality?

With only 15 feet of temporary channel disturbance, potential stream functions were assessed informally by a wetland scientist. The dredging activity will occur during summer months when rainfall is lowest and the potential need for flood desynchronization is minimal. Fish usage is limited to warm water-adapted species. The coffer dam and bypass pipe will temporarily remove Junor Lake as fish habitat; however, upstream segments of Woods Creek have sufficient waters for temporary habitat displacement. The proposed activity will not adversely impact water temperatures or water

quality in Woods Creek. Post dredging conditions will have significantly greater sediment trapping and improved water quality functions.

4c. Wetlands Impacts (Quantitative): Will the alternative have impacts to wetlands?

Wetland A: Offset from Fanno Creek and Woods Creek, Wetland A is situated at the southern edge of the golf course property. Wetland A is 0.72-acre and palustrine, emergent wetland, per Cowardin Classification System. The wetland water regime best matches HGM-Slope. It is the only wetland in the project area outside of the flood zones for Fanno and Woods Creeks. While sustained by limited urban runoff and precipitation, Wetland A becomes seasonally dry most years and only connected to Fanno Creek during the rainy season. Wetland A provides wildlife habitat for terrestrial mammals, amphibians and birds, but lacks surface water conditions for fish habitat. Wetland A will be impacted by placement of sediment bags in the wetland.

Wetland B: Situated on a low terrace immediately north of Woods Creek (less than one-half located within project area). Roughly 1 acre and palustrine forested and emergent, per Cowardin Classification System. It has an HGM-Slope water regime. This wetland has connectivity to Woods Creek and occasionally floods when upgradient segments of Woods Creek receive heavy rainfall, sometimes once or twice per year. No impact is proposed to Wetland B, since placement of sediment bags in Wetland B will increase stream flows and downgradient flooding (offsite to southwest), as well as reduce onsite sediment trapping.

Wetland C: Portions of Wetland C occur at the base of a retaining wall that encloses Junor Lake. It is anticipated the sediment dredging will replace such portions of Wetland C with open water. There are other portions of Wetland C that consist of mowed lawn near the retaining wall. All of the alternatives will avoid permanent impacts to terrestrial portions of Wetland C.

4d. Wetlands Functions (Qualitative): Will the alternative have impacts to wetlands quality?

Wetland functions are assessed using Oregon Rapid Wetland Assessment Protocol (ORWAP). Such methodology generates a summary of findings, which is included in Appendix F of the JPA. Wetland functions potentially affected by the proposed dredging and sediment bag placement are limited to Wetlands A and C. Wetland A primarily provides terrestrial habitat, water quality, songbird, and amphibian habitat functions (breeding, nesting and feeding). It has incidental or indirect functions for water storage (desynchronization), sediment trapping, seasonal water for fisheries, carbon sequestration, and nutrient cycling. Wetland C functions are associated with the open water of Junor Lake, namely emergent habitat, water fowl feeding, amphibian nesting and feeding (invertebrates), fisheries support, nutrient cycling, and sediment trapping.

4e. Wildlife Impacts (Quantitative): Will the alternative have impacts to wildlife?

The proposed dredging activity and sediment bag placement will not impact habitat for any rare, threatened, or endangered species. Anticipated impacts to wildlife are displacement of wetland-dependent species, such as amphibians, songbirds, small mammals, and invertebrates. Loss of such habitat will displace wildlife to the east and/or west where Fanno Creek and Woods Creeks provide similar habitats. In general, impacts to wildlife are proportional to the degree of land disturbance and loss of cover or vertical structure.

4f. Wildlife Functions (Qualitative): Will the alternative have impacts to wildlife quality/diversity?

Urban wildlife functions are evaluated within the context that potential habitat is already highly fractured and affected by stressors like artificial lighting, vehicle/equipment noises, and human intrusion. Urban wildlife functions are often diminished, when compared to rural and large tracts of forest, range and open space. Typical functions include breeding, nesting and feeding opportunities within brush thickets, forests, and scattered clearings. Wetland-dependent wildlife functions typically incorporate near-surface wetness favorable to amphibians and certain invertebrates.

4g. Forest Upland Impacts (Quantitative): Will the alternative have impacts to forest uplands?

Upland forests and forested corridors occur throughout the PGC property, and extend offsite along Woods Creek and Fanno Creek. The alternatives proposed to avoid potential impacts to forest lands, since such areas require 50 to 100 years to mature. Additionally, loss of forest lands within an urban area increases summer temperatures, reduces wildlife habitat, decreases water quality, and interrupts migration corridors.

4h. Forest Upland Functions (Qualitative): Will the alternative have impacts to forest uplands quality?

Forested habitats have many terrestrial functions for urban wildlife, namely breeding, nesting, feeding, and migration. These habitats provide vertical habitat for small mammals and birds sensitive to ground predation. Forested areas also provide shelter from rain/snow with dense foliage, nesting cavities, natural platforms atop branches, and snags for perching. Forest area provide refugia for small mammals and song birds that reside offsite, but occasional travel through such corridors. Additionally, nearby residents greatly desire tall trees for visual purposes, windbreaks, air quality and temperature regulation. Humans also have a great affinity for urban wildlife, wildlife sounds, and diversity of other species utilizing forested habitats.

5. Cost

A comparative analysis of the cost of different alternatives. If the cost of an alternative is clearly exorbitant compared to similar actions and the proposed alternative, the alternative is eliminated as not practicable.

Projects costs include, but are not limited to, dredging, excavation and grading (land contouring), sediment bag placement or alternative transportation and disposal, and labor. Some alternative scenarios include the costs of bridge replacement, temporary road construction, alternative reservoir construction, fairway rehabilitation, trucking, and more. The cost of compensatory mitigation is not factored into any of the alternative scenarios. Also, the costs do not include profits or other financial gains to the golf course from the project, but do take into consideration the damages to the golf course caused by project interference and/or permanent impairments.

5a. Dredging, Excavation, or Reservoir Costs:

The floating dredge and pumping system expenses include mobilization, set-up, operations for 6 to 8 weeks, demobilization, and ground rehabilitation.

5b. Sediment Bag Placement Cost:

This category includes expenses for sediment bag manufacturing, staging area preparation, grading, operations for 6 to 8 weeks, soil cover placement, and staging area rehabilitation.

5c. Infrastructure Costs:

Several alternatives require supplemental work for construction access, such as bridge replacement, temporary road construction, fairway rehabilitation, and protection of subsurface utilities.

5d. Implementation Costs:

Each alternative results in disruption of golf course operations and player utilization of golf course fairways. The dredging approach with sediment bag placement at Wetland A minimizes such disruption with temporary closures for pipe installation, setup and decommissioning. Several alternatives require closure of entire fairways for construction of access roads, and/or sediment bag

placement. And a few alternatives would reduce length of fairways and/or result in extensive damage to fairways that must rebuild the underlying drainage network and new turf. The cost of these rehabilitation efforts is an unavoidable project expense. Not included in this cost are temporary loss of revenue, loss of membership and loss of tournament income, which are difficult to assess for this alternatives analysis, and are therefore considered without precise dollar figures.

6. Other Qualitative Factors

Other qualitative factors are necessary to evaluate the relative suitability and practicability of alternatives to fulfill the basic and overall/specific purposes of the project. These factors are assessed on a yes/no basis as related to essential elements of the golf course. Alternatives that do not satisfy these factors will damage the golf course property and therefore cannot fulfill the basic and overall/specific purposes for the project. Moreover, if PGC cannot maintain a world-class golf course, event sponsors will no longer hold golf tournaments at PGC. Attached in support of these criteria and the associated analyses are letters from golf course architect, Dan Hixson, and golf course advisor, Henry DeLozier.

6a. Complete Golf Course: Will the alternative maintain the use of all 18 holes of the golf course, as well as practice greens and the driving range?

6b. Design Integrity: Will the alternative maintain the design integrity of the golf course, including the tees, greens, roughs, and golfing hazards?

6c. Drainage: Will the alternative maintain optimal soil and drainage conditions to support golf course irrigation and landscaping?

6d. Accessory Work Areas: Will the alternative maintain accessory work areas that are essential to golf course functions, such as a yard debris area and turf farm?

Sediment Excavation versus Sediment Dredging

The proposed dredging and sediment bag placement project is complex. Removing sediment from Junor Lake has only two approaches – excavation or dredging. To excavate, the pond must be drained, haul roads constructed, sediment lifted out with excavators and bulldozers, and reconstruction of damaged fairways, retaining walls, and associated landscaping. Such approach involves a lot of machinery, equipment operators, truckers and inspectors. Unlike most excavation projects, removal of the sediment will be messy, destructive, and risky due to potential opportunities for spillage, equipment failures and unintentional accidents. In contrast, the dredging approach is rather surgical, with only the dredge cutting head and discharge pipeline having contact with the removed sediment. The equipment needed is limited to a floating dredge, pump and generators, temporary pipeline laid on the surface, and a pilot aided by several assistants. To keep the dredge floating, water will captured at the sediment placement site and pumped back to Junor Lake (hence a closed loop). There would be no water discharge to Fanno or Woods Creeks. The dredging approach is clearly the Least Environmentally Damaging Practicable Alternative for the removal of the accumulated sediment in Junor Lake.

Onsite Sediment Containment versus Onsite Sediment Bag Placement

Placement or hauling of the dredged sediment also has limited approaches, namely onsite containment cells, onsite sediment bags, and offsite disposal. All approaches involve removal (salvage) of topsoil, excavation of subsoil to desired grades, final contouring, and eventual return placement of the salvaged topsoil. Construction of sediment containment cells requires extensive work to create basins capable of holding a slurry of sand, silt, clay, and water. Such basins must be of sufficient size to hold the materials – either hauled in by truck, or pumped from dredge. Such construction is involves excavators, bulldozers, soil compactors, culverts, rock spillways, and road construction directly to each containment cell. In contrast, construction for sediment bag placement utilizes less space (hence less grading) to build

a sloping surface and small downgradient berm to capture and recycle drainage water. Such construction requires fewer excavators and bulldozers, as well as less durable road construction (for pickups, rather than 12CY dump trucks). The sediment bag placement approach also requires less water storage capacity, since the drainage water is continuously cycled back to Junor Lake to maintain water levels for the floating dredge. The sediment bag placement approach, compared to containment cell approach, is the Least Environmentally Damaging Practicable Alternative.

Equipment/Truck Access From North of Fanno Creek versus Access From South of Fanno Creek.

Several alternative explored by the project team highlight a significant issue for either transporting sediment by truck or use of heavy equipment. Access from the north side of Fanno Creek is via S.W. Scholls Ferry Road and an interior road designed for pickups and maintenance carts. To access Junor Lake, it is necessary to use a weight restricted bridge, since it is old. While pickup trucks can utilize the bridge, it is not sufficiently strong to bear the weight of loaded dump trucks or equipment like excavators, or bulldozers. A replacement bridge is needed for such use, which has an estimated cost of $800,000 for engineering and construction. It is cost-prohibitive to replace the bridge for this project, as well as logistically difficult to bring in cranes, flatbed trailers and concrete mixing trucks to place the bridge decking.

In contrast, truck and heavy equipment access to the southernmost portion of the property (where sediment placement is proposed) is possible with safety and structural precautions. Specifically, it is necessary to add steel plating atop the Fanno Creek trail (paved path) to prevent damage to underlying sewer lines. The preferred alternative would have minimal crossings by heavy equipment and loaded dump trucks. Several other alternatives that would haul away the sediment would require further reinforcement to protect the underground utilities. That is, there is a significant risk of damage to the sewer lines when up to 600 roundtrips of dump trucks must cross the Fanno Creek trail. Regardless, the alternatives which haul away the sediment will have dump truck fuel usage of 2500 and 3000 gallons, as well as street sweeping needs. The truck hauling alternatives require additional handling (movement) of the sediment, tipping fees and associated labor adds a minimum of 520,000 to the project cost. Aside from the logistical challenges, hauling away the sediment can only be done during the dry season when construction costs are highest and pedestrian use of Fanno Creek is greatest.

Project Alternatives and Criteria Evaluation

No-Action Alternative

The no-action alternative will result in Junor Lake filling with silts and clays, and eventually becoming a vegetated marsh. The irrigation uptake structure will become unusable due to clogging and the pumping system running dry, causing PGC to be unable to use water from the lake. PGC's state-issue water storage right will be forfeited and potentially cancelled, and PGC will not be able to utilize its other water rights without several acre-feet of water storage to irrigate the golf course with high volume pumps. Without irrigation, turf and landscaping at the golf course will die and the golf course will become unusable. Specifically, the turf will seasonally become dormant, weeds will invade lawn areas, turf quality will become hard and undesirable, and golfing use will plummet to unsustainable levels. PGC will not be able to host events. The no-action alternative is unviable and will ultimately destabilize the golf course and force its closure. The no-action alternative cannot meet the project purpose.

No-Action Alternative			
Project Criteria		**Met**	**Comments**
Site Size	1a. Water Storage/Supply Size	N	Sediment will replace water storage in Junor Lake.
	1b. Sediment Disposal Size	N/A	Not applicable.
Site Availability	2a. Water Storage/Supply Availability	N	Loss of water storage will result in forfeiture of water rights
	2b. Sediment Disposal Availability	N/A	Not applicable.
Logistics	3a. Water Use Infrastructure	N	Sediment accumulation in Junor Lake will clog irrigation system intake and irrigation will cease.
	3b. Construction Ingress/Egress	N/A	Not applicable.
	3c. Infrastructure Damage Avoidance	N	Ongoing sediment accumulation will block water control gates for Junor Lake and irrigation system intake will become non-functional. Loss of water storage may also increase erosion around downstream bridge abutments. Some underground utilities (downgradient) may become seasonally unserviceable.
Environmental Impact	4a. Stream Impacts	N	As Junor Lake fills with sediment, Woods Creek will also accumulate sediment, resulting in offsite backflooding and increase onsite flooding frequency.
	4b. Stream Functions	Y	Loss of in-stream flood storage will destabilize creek banks and collapse sidewalls. Increased sediment in creek channel reduces fish and invertebrate habitat.
	4c. Wetland Impacts	N	Wetland C (Junor Lake fringe) will expand, while open water is eventually displaced by accumulated sediments.
	4d. Wetland Functions	Y	As sediment fills Junor Lake, Wetland C will have reduced flood storage capacity of pond, and convert open water to palustrine, emergent wetland. Reduced waterfowl use.
	4e. Wildlife Impacts	N	Reduced waterfowl use due to loss of open water. Incidental increased opportunity for songbird and migratory birds.
	4f. Wildlife Functions	N	While decreased use for waterfowl, there is a minor increase for song bird nesting and feeding, and slight improved habitat for amphibians (due to less open water).
	4g. Forest Upland Impacts	N	No impact to upland forests.
	4h. Forest Upland Functions	N	No impact to upland forests.
Cost	5a. Dredging or Excavation and Reservoir Cost	N/A	Not applicable.
	5b. Sediment Bag Placement Cost	N/A	Not applicable.
	5c. Infrastructure Cost	N	An unknown range of modifications will be attempted to keep the golf course running as long as possible, but will eventually become ineffective
	5d. Implementation Cost	N	Approximately $25 million loss when golf course closes
Other Qualitative Factors	6a. Complete Golf Course	N	Lack of irrigation will cause necessary elements of the golf course to be unusable
	6b. Design Integrity	N	A golf course without irrigation cannot perform landscaping upkeep to maintain landscape design elements
	6c. Drainage	N	The golf course will not be capable of continued irrigation
	6d. Accessory Work Areas	N	The golf course will not be able to maintain its turf farm or perform dust management in work areas

Sediment Excavation Alternative

PGC previously submitted (and later withdrew) a wetland fill application for the same sediment removal project, using excavation instead of dredging as proposed in the current application. To remove the accumulated sediment by excavation, Junor Lake will be dewatered by draining water via control gates, then pumping remaining water with submersible pumps. The sediment will be removed using one or more excavators (aka trackhoes), and a bulldozer. Excavators with smooth-bucket shovels will transfer the gel-like sediment into dump trucks with special liner beds. The trucks will haul the sediment to

Wetland A for placement in constructed containment cells. Such cells need to be located where water and sediments can be sequestered, such as the low topographic setting of Wetland A. It will be necessary to construct a haul road for the dump trucks to cross three fairways. Topsoil at Wetland A will be excavated with a trackhoe and/or bulldozer (it is seasonally dry in summer months), then such equipment will sculpt the sloping swale into three containment cells. The containment features will be built with soil excavated from adjacent upland using a trackhoe and/or bulldozer. This approach will create similar rock and geofabric check dams in the narrow outlet for Wetland A. Dump trucks will progressively fill the containment cells with excavated sediment. Throughout this excavation process, dump trucks, service trucks and limited heavy equipment will utilize internal golf course roads and bridges, and residential street(s) for ingress/egress. When excavation is complete, the containment cells will be seeded with native grasses and forbs, then allowed to naturally drain off excess water.

This alternative is rejected due to greater damage to forested upland habitat, significantly greater interruption to golf course usage, and higher project costs. Specifically, this alternative is more costly because it requires 4 to 8 dump trucks to be retrofitted with sealed beds to prevent water and sediment leakage when travelling to the sediment placement area. It also involves construction of a haul road between Junor Lake and the sediment placement area. Another cost is the repair of subsurface drainage pipes and irrigation lines that will be unavoidably damaged by truck traffic. The repair to fairway and subsurface infrastructure will cost approximately $200,000 in addition to the cost of excavation, hauling, and containment cell construction. Another factor that makes this alternative less viable is the removal of approximately 40 trees for the haul road and a larger staging area next to the sediment placement area. Since this alternative will cause significant interruption to 6 fairways, 1 tee box, and 1 putting green, it reduces the number of active players by 10 to 15 percent. In turn, this alternative decreases daily revenue by a similar amount for 2 months of excavation and hauling, and 9 months for fairway restoration and subsurface replacement. While the revenue loss is a contributing factor in rejecting this excavation alternative, more importantly, it has the same impact to Wetland A, higher construction costs, and substantially greater upland habitat loss.

Sediment Excavation Alternative			
Project Criteria		**Met**	**Comments**
Site Size	1a. Water Storage/Supply Size	Y	Removes accumulated sediment from Junor Lake.
	1b. Sediment Disposal Size	Y	About 3.5 acres including Wetland A and surrounding land for staging, containment cell grading, and temporary topsoil storage
Site Availability	2a. Water Storage/Supply Availability	Y	Excavation will restore water capacity of Junor Lake.
	2b. Sediment Disposal Availability	Y	Vicinity of Wetland A has an appropriate topographic setting for containment cell and adjacent upland for infiltration of drainage water (from containment cells)
Logistics	3a. Water Use Infrastructure	Y	Will maintain the viability of PGC's irrigation system
	3b. Construction Ingress/Egress	N	Containment cell construction is accessible via SW 82nd Ave across Fanno Creek trail; excavation equipment access requires temporary haul road across Fairways 13, 14 and 15. Bridge weight constraints prohibit access via SW 86th Ave. (near maintenance buildings).
	3c. Infrastructure Damage Avoidance	N	Damage will occur to subsurface irrigation and drainage systems and to Fairways 13, 14 and 15; steel plating is necessary to protect underground sewer lines and utilities below Fanno Creek trail
Environmental Impact	4a. Stream Impacts	Y	No impact to Fanno Creek, temporary coffer dam placed in Woods Creek with bypass pipe to isolated flow during excavation
	4b. Stream Functions	Y	Temporary loss of fish, invertebrate and amphibian habitat during excavation phase, but improved habitats after project completion (when temporary controls removed).

	4c. Wetland Impacts	Y	Containment cell grading and sediment placement will impact entirety of Wetland A; emergent fringe of Junor Lake will be reduced by excavation of sediment. Temporary impact to terrestrial Wetland C during excavation phase, but restored after project completion; Wetland B is avoided
	4d. Wetland Functions	Y	Loss of water storage, terrestrial and amphibian habitat, songbird nesting and feeding, and carbon sequestration within Wetland A.
	4e. Wildlife Impacts	Y	Most birds and small mammals will be displaced by excavation and sediment placement activity (due to ground disturbance, construction noise and equipment movement)
	4f. Wildlife Functions	Y	Typical nesting, breeding and feeding habitat loss during excavation and sediment placement phase. Except for tree-dependent wildlife, most wildlife functions restored over subsequent decade after project is completed.
	4g. Forest Upland Impacts	Y	Temporary access road and containment cell grading will impact 40% of forested upland adjacent to Wetland A
	4h. Forest Upland Functions	Y	Removal of 40 trees from upland forest near Wetland A will reduce habitat for song birds, predatory birds, small mammals, and increase fragmentation of forest corridor along former electric railroad alignment.
Cost	5a. Dredging or Excavation and Reservoir Cost	Y	Approx. $450,000 for excavation, temporary road construction/ removal, and onsite trucking of excavated sediment
	5b. Sediment Bag Placement Cost	Y	Approx. $250,000 for staging, grading of containment cells, and post-construction revegetation (larger disturbance area)
	5c. Infrastructure Cost	N	Approx. $50,000 for temporary access via S.W. 82nd Avenue, including steel plate covers for sewer lines/utilities (increased truck traffic); approx. $200,000 cost to remove temporary road and replace damaged irrigation and drainage systems in Fairways 13, 14 and 15
	5d. Implementation Cost	N	About 30 days disruption to golf course for mobilization, set-up, temporary road removal; about 9 months rehabilitation for damage to Fairways 13, 14 and 15; daily disruption to golf course for 3 hours each day for truck transport across fairways
Other Qualitative Factors	6a. Complete Golf Course	N	Multiple fairways will be disrupted for an extended period of time
	6b. Design Integrity	Y	When all work is completed, the golf course will maintain its essential elements
	6c. Drainage	Y	When all work is completed, PGC will be able to maintain its irrigated landscaping
	6d. Accessory Work Areas	Y	No impact to accessory work areas

Periodic (Reduced) Dredging and Sediment Disposal Alternative

Agency personnel inquired about dredging less sediment material, and thus disposing of a correspondingly lower volume of sediment. PGC's project need requires dredging 5,300 cubic yards of sediment from Junor Lake to maintain its state-issued water rights and avoid damage to its irrigation system. This alternative is downsized version of the Preferred Alternative; consequently, dredging and sediment bag placement costs are less in the short-run, but fixed expenses for equipment mobilization, dredge piping and pumps, Fanno Creek trail infrastructure protection, sediment check-dams and other temporary structures, and ground restoration remain unchanged. Since this approach does not restore water storage capacity to Junor Lake, this downsized alternative does not satisfy the project purpose. Instead, this alternative defers the same wetland impacts to a future time (presumably 10 years later) when sediment accumulation in the irrigation requires removal. That is, future dredging will eventually impact the entirely of Wetland A. Future dredging conducted on a more frequent basis done on a smaller

scale is not practicable and it is more costly due to repeatedly incurring fixed expenses with each future dredging.

Periodic (Reduced) Dredging & Sediment Disposal Alternative			
Project Criteria		**Met**	**Comments**
Site Size	1a. Water Storage/Supply Size	N	Sediment will replace some water storage in lake
	1b. Sediment Disposal Size	N	Less sediment will be removed
Site Availability	2a. Water Storage/Supply Availability	N	Failure to restore Junor Lake storage capacity will result in partial forfeiture of water rights
	2b. Sediment Disposal Availability	Y	Less sediment will be removed
Logistics	3a. Water Use Infrastructure	N	Lake infill will damage the irrigation system
	3b. Construction Ingress/Egress	Y	Dredge equipment access via existing maintenance road connecting S.W. Scholls Ferry Road and interior bridge over Fanno Creek; dredge mobilization on tilt-trailer towed by pickup; sediment bag placement construction access to S.W. 82nd Avenue (crossing Fanno Creek trail)
	3c. Infrastructure Damage Avoidance	Y	Dredge slurry pipes placed atop turf avoids damage to subsurface irrigation and drainage systems in Fairways 13, 14 and 15; steel plating necessary to protect underground sewer lines and utilities below Fanno Creek trail
Environmental Impact	4a. Stream Impacts	N	Only temporary impacts to creek bed and sidewalls for coffer dam and bypass pipe. Full restoration upon removal. Similar temporary impacts repeated for future dredging.
	4b. Stream Functions	N	No permanent loss to stream function, but long-term gain in water quality, temperature regulation, and sediment trapping. Stream functions will have similar improvements as the preferred alternative.
	4c. Wetland Impacts	Y	Sediment bag placement will impact a portion of Wetland A
	4d. Wetland Functions	Y	Emergent fringe of Junor Lake partially replaced with open water, adjacent terrestrial wetland (lawn) avoided
	4e. Wildlife Impacts	Y	Partial filling of Wetland A will displace breeding, nesting and feeding habitat for wetland-dependent songbirds, small mammals, and amphibians. Temporary displacement of invertebrate habitat within pond fringe (Wetland C).
	4f. Wildlife Functions	Y	Loss of wildlife functions is limited to land disturbance, which is smaller than preferred approach. Future dredging will also have temporary, incidental wildlife function disturbances.
	4g. Forest Upland Impacts	N	No impact to upland forests
	4h. Forest Upland Functions	N	No impact to upland forests
Cost	5a. Dredging or Excavation and Reservoir Cost	N:	Partial dredging of sediments will cost approx. $300,000, which includes mobilization, operations, and removal. This cost repeated twice more in subsequent 30 years.
	5b. Sediment Bag Placement Cost	Y	Approx. $100,000 for manufacturing, ground preparation and post-construction revegetation. This cost repeated twice more in subsequent 30 years.
	5c. Infrastructure Cost	Y	Approx. $50,000 for temporary access via S.W. 82nd Avenue, including steel plate covers for sewer lines/utilities. This cost repeated twice more in subsequent 30 years.
	5d. Implementation Cost	Y	About 10 days disruption to golf course for mobilization, set-up, post-dredging turf restoration; golf course disruption limited to Fairways 7, 11, 13, 14 and 15 for 1 hour durations
Other Qualitative Factors	6a. Complete Golf Course	Y	Temporary disruption to essential elements of the golf course
	6b. Design Integrity	N	Junor Lake will have insufficient long-term maintenance and water storage
	6c. Drainage	N	The golf course irrigation system will be damaged and PGC will not be able to adequately irrigate the grounds
	6d. Accessory Work Areas	N	With less water, the golf course will not be able to maintain its turf farm or perform dust management in work areas

New Site for Golf Course Alternative

Applicant began its alternatives analysis evaluation in January of 2020 by considering approaches to remove accumulated sediment in Junor Lake and potential options for sediment placement or offsite transport. Unlike construction of a new residential subdivision, commercial center, or industrial facility, the golf course cannot be relocated to a different property. It is surrounded by residential subdivisions and schools in all directions, so it is land-locked. The nearest vacant ground of sufficient size and suitability is more than six miles to the southwest and situated outside the Urban Growth Boundary. Such location does not serve the golf course membership, who live locally, and a replacement location would double or triple their commute to the golf course. PGC's water rights permit use of local water sources that cannot be piped or transferred to a distant new site. Additionally, the cost of constructing a new golf course would far exceed any other alternative discussed herein. As such, an alternate golf course location is not viable or practicable under any circumstance and will not satisfy the project purpose.

Replacement Golf Course Alternative			
Project Criteria		**Met**	**Comments**
Site Size	1a. Water Storage/Supply Size	Y	New water source will be sized for irrigation needs
	1b. Sediment Disposal Size	N/A	No sediment disposal.
Site Availability	2a. Water Storage/Supply Availability	N	New water rights must be secured go irrigate new golf course
	2b. Sediment Disposal Availability	N/A	Not applicable.
Logistics	3a. Water Use Infrastructure	Y	New construction will utilize water control structures
	3b. Construction Ingress/Egress	Y	New construction will have street access..
	3c. Infrastructure Damage Avoidance	Y	New construction will avoid damage to existing infrastructure
Environmental Impact	4a. Stream Impacts	--	To be determined upon new site selection
	4b. Stream Functions	--	To be determined upon new site selection
	4c. Wetland Impacts	--	To be determined upon new site selection
	4d. Wetland Functions	--	To be determined upon new site selection
	4e. Wildlife Impacts	--	To be determined upon new site selection
	4f. Wildlife Functions	--	To be determined upon new site selection
	4g. Forest Upland Impacts	--	To be determined upon new site selection
	4h. Forest Upland Functions	--	To be determined upon new site selection
Cost	5a. Dredge or Excavation and Reservoir Cost	N/A	No pond dredging.
	5b. Sediment Bag Placement Cost	N/A	No sediment bag placement.
	5c. Infrastructure Cost	N	Approx. $10 million for new infrastructure, including water supply, wastewater treatment, gas-electric-cable installation, as well as development fees for planning, fire protection, etc.
	5d. Implementation Cost	N	Approx. $30 million for excavation, grading, roads, irrigation and drainage systems, buildings, maintenance facilities, landscaping and other recreational features; cost of land is undetermined, but sale of the current property may provide funds for new property acquisition
Other Qualitative Factors	6a. Complete Golf Course	--	To be determined upon new site selection
	6b. Design Integrity	--	To be determined upon new site selection
	6c. Drainage	--	To be determined upon new site selection
	6d. Accessory Work Areas	--	To be determined upon new site selection

Replacement Irrigation Pond Alternative

This alternative proposes constructing a new irrigation pond in the vicinity of Junor Lake, such as directly to the south or east. Pond construction will close 3 fairways for 12 to 18 months for preparation, excavation, and fairway reconstruction/realignment. Potential locations north and west of Junor Lake are too congested for a 1.5- to 2-acre pond, since such areas have insufficient space to reconfigure existing

tee boxes, fairways, bunkers and greens. Excavated spoils will be transported by dump truck to uplands flanking Wetland A; however, access to such area will have an unavoidable impact to Wetland A (about 0.3-acre). Potential areas to the east are limited by topography existing waterways (Fanno Creek and Woods Creek). Specifically, positioning a new irrigation pond immediately to the east would more than double the distance that golfer must hit golf balls over a water hazard, which would destroy the golf course design and make the course not playable.

Constructing a new irrigation pond to the south will add water hazards to fairways no. 13 and 14 (both par 4). Such hazards will substantially increase play difficulty, resulting in par 5 fairways. Considering the need to balance play difficulty with inherent variety of play conditions, additional water hazards are undesirable challenges for the majority of golfers that encounter water hazards on fairways no. 7 and 11. Again, this would damage the property for use as a golf course.

The area south of the existing Junor Lake will have an additional problem – no connection to Fanno Creek and Woods Creek. Both creeks are 4 to 6 feet topographically lower than fairways no. 13 and 14, which makes it impractical to divert water into a new irrigation pond. It will also be impossible to obtain local, state and federal approvals to reroute Fanno and Woods Creeks to connect to a new irrigation pond. Unless constructed with a flexible liner (rubber), natural siltation and capture of eroded sediments from the side banks of the replacement pond will require the replacement pond to be periodically dredged or excavated similar to Junor Lake.

Ultimately, these alternative irrigation pond locations will require permanent changes to several fairways that will damage the use of the PGC property as a golf course. Furthermore, PGC hosts several golf tournaments each year, and occasionally hosts national and international golf tournaments. Such tournaments are valuable to retaining memberships and make a significant economic benefit to the local community in terms of lodging, food service, tourism, car rentals, and recreation. Hosting such tournaments requires the course to meet national guidelines for course length and fairway configuration. The alternate pond locations have such significant impacts that PGC will no longer be eligible for national and international tournaments, and likely fewer local tournaments. This alternative is not viable and actually detrimental to the PGC membership and long-term sustainability of the property. New pond construction will temporarily close three fairways for 1 year and drastically reduce revenue (green fees and pro shop sales that cover day-to-day expenses) and decreases new memberships.

Finally, there is significant legal risk in attempting to relocate the points of diversion for any new irrigation pond. The Oregon Water Resources Department determined it cannot approve applications to change (transfer) places of use or points of diversion for storage water rights. The Oregon Legislature has since amended ORS 540.510(1)(b) to allow changes to the character of use for stored water (for example, changing the use from irrigation to aesthetic), but changes to points of diversion and places of use for stored water are still not allowed. Absent another change in the law, PGC would have to use water illegally on its property to change the location of the stored water and points of diversion, resulting in potential cancellation of PGC's water rights. See attached memo from the Oregon Department of Justice regarding the Department's lack of authority to transfer storage water rights.

Replacement Irrigation Pond Alternative			
Project Criteria		**Met**	**Comments**
Site Size	1a. Water Storage/Supply Size	Y	A new pond of similar size is capable of being constructed
	1b. Sediment Disposal Size	N/A	No sediment will be removed from Junor Lake
Site Availability	2a. Water Storage/Supply Availability	N	A new pond can be constructed to hold a sufficient quantity of water, however, the water rights for the pond cannot be modified to allow storage in a new pond
	2b. Sediment Disposal Availability	N/A	No sediment will be removed from Junor Lake
Logistics	3a. Water Use Infrastructure	N	Woods Creek and Fanno Creek will not be connected to the new pond and cannot be rerouted to the new pond location
	3b. Construction Ingress/Egress	N	New irrigation pond access from S.W. 82nd Avenue (crossing Fanno Creek trail); temporary road construction across Fairways 13, 14 and 15, as well as through part of upland forest east of Wetland A

	3c. Infrastructure Damage Avoidance	N	Irrigation pipelines installed through Fairways 7, 8, 11 and 13; thus significant damage to subsurface irrigation and drainage systems; steel plating necessary to protect underground sewer lines and utilities below Fanno Creek trail
Environmental Impact	4a. Stream Impacts	N	No permanent impact to Fanno or Woods Creeks, but temporary disturbance to both creeks for conveyance pipes between new irrigation pond and pumping station
	4b. Stream Functions	Y	Lack of water storage in Junor Lake will likely cause back-flooding in Woods Creek during heavy rain events
	4c. Wetland Impacts	Y	Grading impact to approx. 30-40% of Wetland A; higher functioning Wetland B is avoided; emergent fringe of Junor Lake would expand to entire lake as sediment accumulates (Wetland C)
	4d. Wetland Functions	Y	Water quality, nutrient cycling, and sediment trapping functions removed.
	4e. Wildlife Impacts	Y	Songbird, small mammals and amphibian habitats associated with portion of Wetland A removed.
	4f. Wildlife Functions	Y	Habitats for breeding, nesting and feeding will be further fragmented that reduces usage for migration-oriented wildlife. Songbird and small mammals habitat degraded by reduced forest area.
	4g. Forest Upland Impacts	Y	Construction and disposal of new irrigation pond spoils will impact 30% of forested upland adjacent to Wetland A
	4h. Forest Upland Functions	Y	Forest uplands will be further fragmented that reduces usage for migration-oriented wildlife. Songbird and small mammals habitat degraded by reduced forest area.
Cost	5a. Dredge or Excavation and Reservoir Cost	N	Approx. $1.2 million for excavation, temporary road to south part of property, trucking spoils to upland flanking Wetland A, and an additional $100,000 for re-vegetation of disturbed ground
	5b. Sediment Bag Placement Cost	N/A	No sediment removed from Junor Lake
	5c. Infrastructure Cost	Y	Approx. $50,000 for temporary access via S.W. 82nd Avenue, including steel plate covers for sewer lines/utilities (increased truck traffic), plus, $75,000 cost to remove temporary road and replace damaged irrigation and drainage systems in Fairways 13, 14 and 15
	5d. Implementation Cost	N	About 20 days disruption to golf course for mobilization, set-up, and construction; disruption to golf course for 60 days for new irrigation pond excavation and pipe installation across 5 fairways; 12 months rehabilitation for damage to Fairways 7, 8, 11, 13, 14 and 15; reduced length of Fairway 13 diminishes golf play and reduces opportunities for tournaments
Other Qualitative Factors	6a. Complete Golf Course	N	Reduced length of Fairway 13 removes an essential element of the golf course
	6b. Design Integrity	N	Reduced length of Fairway 13 damages the golf course design and precludes ability to hold golf tournaments
	6c. Drainage	N	Water rights cannot be modified to allow use from new irrigation pond
	6d. Accessory Work Areas	Y	No impact to accessory work areas

Metal or Concrete Reservoir Alternative

This alternative is similar to the preceding alternative insofar as requiring adequate space and access to Woods Creek. The needed water capacity for a standing reservoir storage will be one 10-foot tall tank with 150-foot diameter or two 10-foot tall tanks with 80-foot diameters. Such reservoir(s) will need to be constructed of steel or concrete. The only vacant area within the PGC property having suitable size and location is the same area proposed for the proposed sediment bag placement (Wetland A and adjacent upland to west). Otherwise, the placement on PGC's property will damage the golf course design and

make golf play impossible. The planning and construction will take 18 to 24 months and is estimated cost of $4 million. Using retaining walls, the reservoir(s) will impact 50 to 60% of Wetland A. It will also require temporary closure of the Fanno Creek bike and pedestrian trail, since construction access through the golf course is not practical without replacing a bridge ($800,000) and suspending play on 6 fairways for 18 months. Additional environmental impacts will include removal of dozens of large trees, daily construction traffic through narrow residential neighborhoods, and extensive restoration of disturbed upland and riparian habitat. This alternative will entail the largest amount of construction on the PGC property and greatest degree of disruption to neighbors and visitors, in addition to being more than double the cost of the preferred alternative. Finally, changing the location of stored water under existing storage water rights is not currently authorized under State law.

Metal or Concrete Reservoir Alternative			
Project Criteria		**Met**	**Comments**
Site Size	1a. Water Storage/Supply Size	Y	Utilizes 2.5 acres of upland and 0.5-acre wetland for 1 to 2 reservoirs, including ground leveling and compaction
	1b. Sediment Disposal Size	N/A	No sediment will be removed from Junor Lake
Site Availability	2a. Water Storage/Supply Availability	N	A new reservoir can be constructed to hold a sufficient quantity of water, however, the water rights for Junor Lake cannot be modified to allow storage in a new reservoir
	2b. Sediment Disposal Availability	N/A	No sediment will be removed from Junor Lake
Logistics	3a. Water Use Infrastructure	N	Woods Creek and Fanno Creek will not be connected to the new reservoir and cannot be rerouted to the new reservoir
	3b. Construction Ingress/Egress	Y	Reservoir construction access from S.W. 82nd Avenue (crossing Fanno Creek trail); pumping and piping construction access via existing maintenance road connecting S.W. Scholls Ferry Road and interior bridge over Fanno Creek
	3c. Infrastructure Damage Avoidance	N	Water capture and water delivery pipelines installed through Fairways 7, 8, 11, 13, 14 and 15; thus significant damage to subsurface irrigation and drainage systems; steel plating necessary to protect underground sewer lines and utilities below Fanno Creek trail
Environmental Impact	4a. Stream Impacts	N	No permanent impact to Fanno or Woods Creeks, but temporary disturbance to both creeks for conveyance pipes between new reservoir and pumping station
	4b. Stream Functions	Y	Lack of water storage in Junor Lake will likely cause back-flooding in Woods Creek during heavy rain events
	4c. Wetland Impacts	Y	Grading impact to approx. 30-40% of Wetland A; higher functioning Wetland B is avoided; emergent fringe of Junor Lake would expand to entire lake as sediment accumulates (Wetland C)
	4d. Wetland Functions	Y	Water quality, nutrient cycling, and sediment trapping functions removed.
	4e. Wildlife Impacts	Y	Songbird, small mammals and amphibian habitats associated with portion of Wetland A removed.
	4f. Wildlife Functions	Y	Habitats for breeding, nesting and feeding will be removed and habitat further fragmented that reduces usage for migration-oriented wildlife.
	4g. Forest Upland Impacts	N	Conveyance pipes will avoid the forested upland adjacent to Wetland A
	4h. Forest Upland Functions	N	Conveyance pipes will avoid the forested upland adjacent to Wetland A
Cost	5a. Dredge or Excavation and Reservoir Cost	N	Approx. $4 million for 1 to 2 above-ground reservoirs
	5b. Sediment Bag Placement Cost	N/A	No sediment removed from Junor Lake
	5c. Infrastructure Cost	Y	Approx. $50,000 for temporary access via S.W. 82nd Avenue, including steel plate covers for sewer lines/utilities (increased construction traffic), plus, $100,000 cost to rebuild damaged irrigation and drainage systems in Fairways 7, 8, 11, 13, 14 and 15

	5d. Implementation Cost	N	About 10 days disruption to golf course for mobilization, set-up, and construction.; disruption to golf course for 5 days for dual pipelines installation across 5 fairways; 6 months rehabilitation for damage to Fairways 7, 8, 11, 13, 14 and 15
Other Qualitative Factors	6a. Complete Golf Course	Y	Essential elements of the golf course will be maintained
	6b. Design Integrity	N	Lack of a water hazard damages the golf course design and precludes ability to hold golf tournaments
	6c. Drainage	N	Water rights cannot be modified to allow use from new reservoir
	6d. Accessory Work Areas	Y	No impact to accessory work areas

Well and Domestic Water Source Alternative

During summer months, the golf course may us approximately 200,000 gallons in a single night. This amount (aka 0.6-acre feet) is equivalent to 4300 households (about 10 percent of City of Beaverton). PGC explored alternate sources of irrigation water, namely groundwater (well water), domestic water, and recycled water. Groundwater in this vicinity must be drilled to sufficient depth to yield pumping rates suitable for a golf course (much greater well yield than a simple domestic well and most commercial wells). The only geologic formation that has sufficient yield at the location of the golf course is an aquifer that also has higher salt content than typical drinking water. PGC currently holds water rights for ground water; however, if used alone this ground water permanently damages soil, turf and landscaping, eventually killing the plants. It must be used sparingly and in combination with surface water to prevent the salt toxicity from damaging plants and turf. PGC will need to secure contracts from two water districts for large quantities of water and obtain additional groundwater rights to have sufficient irrigation volumes. That is, potential water suppliers have indicated they cannot not commit to large volume water delivery, so it will be necessary to supplement with groundwater. Furthermore, potential providers will reserve the right to cease water deliveries during periods of excessive heat and/or long-term drought. Without adequate water supply, the golf course will need to close temporarily until water service is resumed, and long-term damage to its landscaping is likely from any such closure. Attached in support of this analysis is a letter from Raleigh Water District. Lastly, population growth in Washington County is expected to increase sufficiently that water providers may eventually cease all deliveries due to competing urban needs (households, retail, and food services, etc.).

The anticipated cost of domestic water will be a least 10 times more expensive than the cost of removing the accumulated sediment from Junor Lake. Over 20 years, the cost of irrigation using domestic water is expected to be a minimum of $6,000,000 but such cost does not account for increased growth in the Portland-Metro area, nor climate change and the need to use larger volumes of water. Consequently, the use of domestic water for PGC irrigation is not practicable and has an added risk that the water supply can be cut off during critical periods or outright ended if there is insufficient water for domestic water use needs.

Well and Domestic Water Source Alternative			
Project Criteria		**Met**	**Comments**
Site Size	1a. Water Storage/Supply Size	N	Junor Lake will be replaced by new connection to new trunk line that distributes water from municipal reservoirs. This approach lacks in-line storage to meet night-time irrigation water volume demand.
	1b. Sediment Disposal Size	N/A	Not applicable.
Site Availability	2a. Water Storage/Supply Availability	N	Existing water rights will be forfeited and replaced with domestic water purchase from water supplier and expanded groundwater rights to meet turf irrigation volume needs; additional groundwater rights may not be granted at location of PGC; local water providers cannot guarantee water deliveries
	2b. Sediment Disposal Availability	N/A	Not applicable.

Logistics	3a. Water Use Infrastructure	N	A pond or reservoir is necessary to hold enough volume and create enough pressure to run the irrigation system
	3b. Construction Ingress/Egress	N	Pipeline construction access via existing maintenance road connecting S.W. Scholls Ferry Road; offsite construction of water delivery trunk line will require extensive use of public right-of-way to connect to municipal reservoir or trunk line with sufficient capacity
	3c. Infrastructure Damage Avoidance	N	Municipal water pipeline installed through Fairways 10 and 18 will result in damage to subsurface irrigation and drainage systems; incalculable installation conflicts with urban infrastructure to install large-diameter trunk line from municipal source
Environmental Impact	4a. Stream Impacts	N	As pond fills with sediment, then Woods Creek would also accumulate sediment, resulting in offsite backflooding and increase onsite flooding frequency.
	4b. Stream Functions	Y	Loss of in-stream flood storage will destabilize creek banks and collapse sidewalls. Increased sediment in creek channel reduces fish and invertebrate habitat.
	4c. Wetland Impacts	N	Wetland C (pond fringe) will expand, while open water is eventually displaced by accumulated sediments.
	4d. Wetland Functions	Y	As sediment fill irrigation pond, Wetland C will have reduced flood storage capacity of pond, and convert open water to palustrine, emergent wetland. Reduced waterfowl use.
	4e. Wildlife Impacts	N	Reduced waterfowl use due to loss of open water. Incidental increased opportunity for songbird and migratory birds.
	4f. Wildlife Functions	N	While decreased use for waterfowl, there is a minor increase for song bird nesting and feeding, and slight improved habitat for amphibians (due to less open water).
	4g. Forest Upland Impacts	N	No impact to upland forests.
	4h. Forest Upland Functions	N	No impact to upland forests.
Cost	5a. Dredge or Excavation and Reservoir Cost	N/A	Not applicable.
	5b. Sediment Bag Placement Cost	N/A	Not applicable.
	5c. Infrastructure Cost	N	Approx. $100,000 for onsite pipeline, and new well having greater water yield; approx. $6 million over two decades for domestic water purchase and offsite trunk line construction; approx. $60,000 cost to rebuild damaged irrigation and drainage systems in Fairways 10 and 18
	5d. Implementation Cost	N	About 6 days disruption to golf course for mobilization, set-up, and construction; disruption to golf course for 3 days for domestic waterline installation across 2 fairways; 12 months rehabilitation for damage to Fairways 10 and 18
Other Qualitative Factors	6a. Complete Golf Course	Y	Essential elements of the golf course will be maintained
	6b. Design Integrity	N	Lack of a water hazard damages the golf course design and precludes ability to hold golf tournaments
	6c. Drainage	N	A pond or reservoir is needed to hold enough water for nigh irrigation
	6d. Accessory Work Areas	N	Without guaranteed water delivery, periods of unavailable water will negatively impact (heat-stress or desiccate) all turf areas, sod farm, and other landscaping features

Recycled Water Source Alternative

Another alternative is construction of two or more water above-ground reservoirs, having an estimated minimum cost of $4 million, and using recycled water to fill the reservoirs. Reservoirs will be constructed of steel and/or reinforced concrete. Two reservoirs are needed because golf course irrigation occurs at night, but recycled water is primarily available during morning to early evenings when human activity also peaks. At present, recycled water (aka treated effluent) is not available, since this option requires a pipeline from the treatment facility located in Tigard (Durham). Several years of planning and

implementation are need to install a large diameter pipe, pump stations, siphons under creeks, and related infrastructure to deliver water to onsite reservoirs. The estimated cost of the pipeline would be a minimum of $5 million and 2 to 3 years of planning, permitting and construction. It is not known if the recycled water would also have an associated volume fee, but the costs of this alternative are already exorbitant. Annual pumping and maintenance of the conveyance system is estimated at $150,000 per year (increasing annually for inflation). The likely location of such reservoirs would be the vacant land in the south part of the golf course property. With retaining walls and grading, it is likely wetland impacts would be under 0.3-acre.

Recycled Water Source Alternative			
Project Criteria		**Met**	**Comments**
Site Size	1a. Water Storage/Supply Size	Y	Utilizes 2.5 acres of upland and 0.3-acre wetland for 2 reservoirs, including ground leveling and compaction
	1b. Sediment Disposal Size	N/A	No sediment will be removed from Junor Lake
Site Availability	2a. Water Storage/Supply Availability	N	Two new reservoirs can be constructed to hold a sufficient quantity of water, however, no connection to receive recycled water currently exists
	2b. Sediment Disposal Availability	N/A	No sediment will be removed from Junor Lake
Logistics	3a. Water Use Infrastructure	Y	New infrastructure can be constructed to connect from the reservoirs to the existing irrigation system
	3b. Construction Ingress/Egress	Y	Reservoir construction access from S.W. 82nd Avenue (crossing Fanno Creek trail); pumping and piping construction access via existing maintenance road connecting S.W. Scholls Ferry Road and interior bridge over Fanno Creek
	3c. Infrastructure Damage Avoidance	N	Recycled water pipes installed through Fairways 7, 8, 11, 13, 14 and 15, thus significant damage to subsurface irrigation and drainage systems; steel plating necessary to protect underground sewer lines and utilities below Fanno Creek trail; incalculable installation conflicts with urban infrastructure to install large-diameter pipe from treatment facility
Environmental Impact	4a. Stream Impacts	N	Additional sediment will remain instream and the connection between Woods Creek and Fanno Creek will be changed; temporary disturbance to both creeks for conveyance pipe between reservoirs and pumping station
	4b. Stream Functions	Y	Lack of water storage in Junor Lake will likely cause back-flooding in Woods Creek during heavy rain events
	4c. Wetland Impacts	Y	Grading impact to approx. 30-40% of Wetland A; higher functioning Wetland B is avoided; emergent fringe of Junor Lake would expand to entire lake as sediment accumulates (Wetland C)
	4d. Wetland Functions	Y	Water quality, nutrient cycling, and sediment trapping functions removed.
	4e. Wildlife Impacts	N	Partial filling of Wetland A will displace breeding, nesting and feeding habitat for wetland-dependent songbirds, small mammals, and amphibians. Temporary displacement of invertebrate habitat within pond fringe (Wetland C).
	4f. Wildlife Functions	N	Habitats for breeding, nesting and feeding will be reduced but not significantly fragmented (compared to pre-impact). Songbird and small mammals habitat degraded by reduced wetland area.
	4g. Forest Upland Impacts	N	No impact to upland forests
	4h. Forest Upland Functions	N	No impact to upland forests
Cost	5a. Dredge or Excavation and Reservoir Cost	N	Approx. $4 million for 1 to 2 above-ground reservoirs, plus additional $5 million for pipeline from Durham facility.
	5b. Sediment Bag Placement Cost	N/A	No sediment removed from Junor Lake
	5c. Infrastructure Cost	Y	Approx. $50,000 for temporary access via S.W. 82nd Avenue, including steel plate covers for sewer lines/utilities (increased construction traffic), plus, $100,000 cost to rebuild damaged irrigation-drainage systems in Fairways 7, 8, 11, 13, 14 and 15

	5d. Implementation Cost	N	About 10 days disruption to golf course for mobilization, set-up, and construction.; disruption to golf course for 5 days for dual pipelines installation across 5 fairways; 12 months rehabilitation for damage to Fairways 7, 8, 11, 13, 14 and 15
Other Qualitative Factors	6a. Complete Golf Course	Y	Essential elements of the golf course will be maintained
	6b. Design Integrity	N	Lack of a water hazard damages the golf course design and precludes ability to hold golf tournaments
	6c. Drainage	Y	Optimal drainage for irrigation of golf course will be maintained
	6d. Accessory Work Areas	Y	No impact to accessory work areas

---

Onsite Sediment Bag Placement in Wetland A (Preferred Alternative)

The sediment will be removed from Junor Lake by floating dredge, then pumped 1300 feet to a sediment placement location immediately south of the playing area. The sediment placement location is 0.72-acre emergent wetland flanked by higher topography on all sides with a narrow outlet. The sediment removal volume is approximately 5300 cubic yards and will be considered permanent removal, and the wetland fill area is 0.72-acre permanent fill. The fill incudes a small portion of Wetland A (where it overflows to the west) that may indirectly become filled with sediment from sediment bag drainage water, so the project impact accounts for such indirect sedimentation. Minor temporary wetland or waters impacts associated with construction measures will also occur. The project will not discharge water to Fanno Creek or Woods Creek. The dredging is expected to take 4 to 6 weeks to complete, with 2 to 4 weeks of preparation and decommissioning afterwards.

The proposed dredging will utilize sediment bag placement to permanently store the removed sediment in the southmost portion of the golf course property. This portion of the golf course property is not currently in use, and such use will not impact the flood storage surrounding Fanno and Woods Creeks. The topography is ideally suited for placing sediment bags with higher ground on all four sides and a narrow outlet. In particular, the land to the east, south, and west slope toward the sediment placement area (known as Wetland A on project maps). Wetland A slopes northwesterly to a former railroad berm that forms a 4- to 6-foot tall impoundment and a narrow overflow to the west. Such sediment bag placement cannot be done on the adjacent slopes without substantial excavation and contouring because the dredge water must be recovered and pumped back to Junor Lake. The bowl-like shape of Wetland A will be difficult to create on adjacent upland. Further, the adjacent upland slopes are also needed for infiltration of captured dredge water that need additional treatment to reduce sediment in the return water to Junor Lake. The preferred alternative meets all project criteria and it can be practicably implemented.

NOTE: A variation of this alternative is utilizing Wetland A for temporary sediment bag placement, letting water drain out, then later hauling away the sediment and restoring Wetland A to pre-disturbance condition. To remove the sediment, the bags are too heavy and not strong enough to be lifted out, so they will need to be cut open to remove the drained sediment. The effort and cost of such removal, then hauling offsite is included in several other alternative, which generally adds $520,000 to the project cost. The presence of inert golf balls in the sediment disqualifies it as 'clean fill' so offsite disposal is not available. Disposal of the sediment with the inert golf balls at an authorized landfill has an approximate fee of $800,000, plus haul cost – such variation is not practicable.

Onsite Sediment Bag Placement in Wetland A - Preferred Alternative			
Project Criteria		**Met**	**Comments**
Site Size	1a. Water Storage/Supply Size	Y	Utilizes existing Junor Lake
	1b. Sediment Disposal Size	Y	About 1.5 acres including Wetland A and surrounding land for staging, grading, sediment bag disposal, and temporary topsoil storage
Site Availability	2a. Water Storage/Supply Availability	Y	Existing Junor Lake will have adequate water storage capacity once dredging is complete
	2b. Sediment Disposal Availability	Y	Vicinity of Wetland A has ideal topographic setting for placement of sediment bags, capture of dredge seepage, and pumping location to return water to Junor Lake
Logistics	3a. Water Use Infrastructure	Y	Junor Lake is compatible with existing water use infrastructure
	3b. Construction Ingress/Egress	Y	Dredge equipment access via existing maintenance road connecting S.W. Scholls Ferry Road and interior bridge over Fanno Creek; dredge mobilization on tilt-trailer towed by pickup; sediment bag placement construction access to S.W. 82nd Avenue (crossing Fanno Creek trail)
	3c. Infrastructure Damage Avoidance	Y	Dredge slurry pipes placed atop turf avoids damage to subsurface irrigation and drainage systems in Fairways 13, 14 and 15; steel plating necessary to protect underground sewer lines and utilities below Fanno Creek trail
Environmental Impact	4a. Stream Impacts	N	No impact to Fanno Creek, temporary coffer dam placed in Woods Creek with bypass pipe to isolated flow during dredging
	4b. Stream Functions	N	No impact to Fanno Creek, temporary coffer dam placed in Woods Creek with bypass pipe to isolated flow during dredging
	4c. Wetland Impacts	Y	Preparatory grading and sediment bag placement would impact entirety of Wetland A; emergent fringe of Junor Lake will be reduced by excavation of sediment. Temporary impact to terrestrial Wetland C during excavation phase, but restored after project completion; Wetland B is avoided
	4d. Wetland Functions	Y	Loss of water storage, terrestrial and amphibian habitat, songbird nesting and feeding, and carbon sequestration within Wetland A.
	4e. Wildlife Impacts	Y	Most birds and small mammals will be displaced by preparatory grading and sediment bag placement activity (ground disturbance, construction noise and equipment movement)
	4f. Wildlife Functions	Y	Typical nesting, breeding and feeding habitat loss during excavation and sediment placement phase. Except for tree-dependent wildlife, most wildlife functions restored over subsequent decade after project is completed.
	4g. Forest Upland Impacts	N	No impact to upland forests.
	4h. Forest Upland Functions	N	No impact to upland forests.
Cost	5a. Dredge or Excavation and Reservoir Cost	Y	Approx. $400,000 for dredge operations
	5b. Sediment Bag Placement Cost	Y	Approx. $125,000 for manufacturing, ground preparation and post-construction revegetation
	5c. Infrastructure Cost	Y	Approx. $25,000 for temporary access via S.W. 82nd Avenue, including steel plate covers for sewer lines/utilities
	5d. Implementation Cost	Y	About 10 days disruption to golf course for mobilization, set-up, post-dredging turf restoration; golf course disruption limited to Fairways 7, 11, 13, 14 and 15 for 1 hour durations
Other Qualitative Factors	6a. Complete Golf Course	Y	Interruption to essential golf course features will be avoided
	6b. Design Integrity	Y	The golf course design will remain intact
	6c. Drainage	Y	PGC will be able to maintain its irrigated landscaping
	6d. Accessory Work Areas	Y	No impact to accessory work areas

Onsite Sediment Bag Placement in Wetland B

This alternative is the same as the preceding alternative, but proposes filling forested upland situated between fairways 11, 12, and 13, and Wetland B instead of Wetland A. Wetland B has a direct connection to Woods Creek and floods when upgradient lands receive heavy rainfall. Potential impacts to Wetland B are likely significant due to loss of flood storage capacity and desynchronization. Placement of sediment bags in Wetland B will likely increase flood flows on downgradient lands (offsite to southwest), as well as reduce insitu sediment trapping. Placement of sediment bags in this location will also destroy a grove of mature ash trees. Sediment bag placement in this wetland will have a significantly greater environmental impact than placement in Wetland A. Finally, the upper portion of this open space is a hillside with 15 to >25% slopes, so it is not suitable for sediment bag placement without substantial excavation and contouring.

Onsite Sediment Bag Placement in Wetland B			
Project Criteria		**Met**	**Comments**
Site Size	1a. Water Storage/Supply Size	Y	Utilizes existing Junor Lake
	1b. Sediment Disposal Size	Y	About 1.5 acres including Wetland B and surrounding land for staging, grading, sediment bag disposal, and temporary topsoil storage
Site Availability	2a. Water Storage/Supply Availability	Y	Existing Junor Lake will have adequate water storage capacity once dredging is complete
	2b. Sediment Disposal Availability	Y	Vicinity of Wetland B will work for sediment disposal, but grading and berming needed for capture of seepage water, then pump return water to Junor Lake
Logistics	3a. Water Use Infrastructure	Y	Junor Lake is compatible with existing water use infrastructure
	3b. Construction Ingress/Egress	Y	Dredge equipment access via existing maintenance road connecting S.W. Scholls Ferry Road and interior bridge over Fanno Creek; dredge mobilization on tilt-trailer towed by pickup. To utilize existing bridge (weight restricted), smaller excavator and bulldozer necessary.
	3c. Infrastructure Damage Avoidance	Y	No damage to subsurface drainage or irrigation pipes, since no fairways to cross.
Environmental Impact	4a. Stream Impacts	N	No impact to Fanno Creek, temporary coffer dam placed in Woods Creek with bypass pipe to isolated flow during dredging
	4b. Stream Functions	N	No impact to Fanno Creek, temporary coffer dam placed in Woods Creek with bypass pipe to isolated flow during dredging
	4c. Wetland Impacts	Y	Preparatory grading and berming would impact the entirety of Wetland B; emergent fringe of Junor Lake will be reduced by excavation of sediment. Temporary impact to terrestrial Wetland C during excavation phase, but restored after project completion; Wetland A is avoided
	4d. Wetland Functions	Y	Loss of water storage, flood desynchronization, terrestrial and amphibian habitat, songbird nesting and feeding, and sediment trapping within Wetland B.
	4e. Wildlife Impacts	Y	Most birds and small mammals will be displaced by preparatory grading and sediment bag placement activity (ground disturbance, construction noise and equipment movement)
	4f. Wildlife Functions	Y	Typical nesting, breeding and feeding habitat loss during excavation and sediment placement phase. Except for tree-dependent wildlife, most wildlife functions restored over subsequent decade after project is completed.
	4g. Forest Upland Impacts	N	No impact to upland forests.
	4h. Forest Upland Functions	N	No impact to upland forests.

Cost	5a. Dredge or Excavation and Reservoir Cost	Y	Approx. $375,000 for dredge operations
	5b. Sediment Bag Placement Cost	Y	Approx. $100,000 for manufacturing, ground preparation and post-construction revegetation
	5c. Infrastructure Cost	N	Approx. $800,000 for replacement bridge over Fanno Creek for excavator and bulldozer.
	5d. Implementation Cost	Y	About 10 days disruption to golf course for mobilization, set-up, post-dredging turf restoration; golf course disruption limited to Fairways 7 and 11 for 1 hour durations
Other Qualitative Factors	6a. Complete Golf Course	Y	Interruption to essential golf course features will be avoided
	6b. Design Integrity	N	The upland trees are part of the golf course design that will be destroyed
	6c. Drainage	Y	PGC will be able to maintain its irrigated landscaping
	6d. Accessory Work Areas	Y	No impact to accessory work areas

Onsite Sediment Placement between Fairways

When evaluating options for sediment bag placement and sediment placement within the golf course property, options are limited, since the majority of the land is already in use for fairways, tees and greens. There are narrow corridors between fairways that contain cart paths, trees and shrubs, and such areas are also heavily used as part of the golf game and overall design of the golf course. To utilize the space between fairways will require relocating cart paths, removing tree/landscaping, and narrowing the fairways. Such narrowing of fairways is detrimental to the golfing game, which makes the golf course less desirable, more difficult and creates a cramped play environment. This will make it less likely that PGC can hold golf tournaments in the future. Furthermore, narrowing of several fairways will require relocation of key infrastructure, like irrigation lines and drainage pipes. The retrofit effort will require closure of fairways for greater than 6 months. Such closure will occur during the summer months when construction is viable, but also when golf play is at a peak, so the work will severely interfere with the property.

Two additional factors for placing sediment between fairways are: the land slope and loss of flood storage parallel to Fanno and/or Woods Creeks. In particular, placement of filled sediment bags near the creeks will decrease capacity of the floodplain and alter the flood dynamics, such as backwater flooding in Woods Creek (offsite to east) or headwater flooding downstream in Fanno Creek. Approximately 10 of the fairways have portions of their slopes greater than 10 percent, which makes sediment bag placement not feasible. For the south side of Fanno Creek, none of the non-floodplain land (between fairways) has appropriate slope (under 10 percent) to be used for sediment bag placement. Steeper slopes, if utilized, will require stair-step excavation to place the sediment bags. Such arrangement will require more space (less efficient stacking of the sediment bags). For the north side of Fanno Creek (fairways no. 1 to 9, except no. 7), space between fairways is already very narrow, often less than 50 feet, which is an insufficient width to place sediment bags. For the purposes of this alternatives analysis, the following text examines theoretical sediment bag placement could occur and have sufficient space to construct containment berms to capture seepage water and return it to Junor Lake. Such construction requires excavators and bulldozers, which are sufficiently heavy and damage cart paths, subsurface drainage lines, irrigation pipes, and cannot be driven across bridges (not structurally strong enough). To maintain golf course appearance and use standards, placement of sediment bags along perimeter of fairways will be temporary; thus, later cut open and hauled to another location using smaller landscape carts. Such transport to a final location will double the cost of sediment bag placement.

Onsite Sediment Placement between Fairways			
Project Criteria		**Met**	**Comments**
Site Size	1a. Water Storage/Supply Size	Y	Utilizes existing Junor Lake
	1b. Sediment Disposal Size	N	There is not a site (or multiple sites) with adequate size between fairways
Site Availability	2a. Water Storage/Supply Availability	Y	Existing Junor Lake will have adequate water storage capacity once dredging is complete
	2b. Sediment Disposal Availability	N	The areas between fairways cannot be modified to provide enough space and other necessary elements for sediment placement
Logistics	3a. Water Use Infrastructure	Y	Junor Lake is compatible with existing water use infrastructure
	3b. Construction Ingress/Egress	Y	Containment berm construction only accessible via SW 86th Ave and via internal cart and maintenance paths. To minimize weight damage to cart paths and interior road, smaller excavator and bulldozer necessary.
	3c. Infrastructure Damage Avoidance	N	Subsurface drainage pipes and irrigation lines will be crushed by heavy equipment and must be rebuilt. Cart paths potentially damaged by same heavy equipment.
Environmental Impact	4a. Stream Impacts	N	No impact to Fanno Creek, temporary coffer dam placed in Woods Creek with bypass pipe to isolated flow during dredging. If sediment bags placed in floodplain, then increased risk of downstream flooding.
	4b. Stream Functions	N	No impact to Fanno Creek, temporary coffer dam placed in Woods Creek with bypass pipe to isolated flow during dredging. If sediment bags placed in floodplain, then flood storage capacity and desynchronization will be reduced.
	4c. Wetland Impacts	N	Emergent fringe of Junor Lake will be reduced by excavation of sediment. Temporary impact to terrestrial Wetland C during excavation phase, but restored after project completion; Wetlands A and B are avoided
	4d. Wetland Functions	N	Temporary displacement of invertebrate habitat within pond fringe (Wetland C). Increased flood storage in Wetland C.
	4e. Wildlife Impacts	Y	Sediment bag placement will remove trees and low shrub which provide shelter and feeding habitat for songbirds and small mammals.
	4f. Wildlife Functions	Y	Loss of bird and small mammal shelter habitat in trees, as well as reduced travel corridors for wildlife that resides offsite.
	4g. Forest Upland Impacts	Y	Sediment bag placement at multiple locations likely requires removal of mature trees, since bags cannot be placed atop tree roots near trunk.
	4h. Forest Upland Functions	Y	Loss of vertical structure, perching and nesting sites for owls, hawks and similar predatory birds.
Cost	5a. Dredge or Excavation and Reservoir Cost	Y	Approx. $500,000 for dredge operations (multiple placement locations increases fixed costs)
	5b. Sediment Bag Placement Cost	Y	Approx. $250,000 for manufacturing, ground preparation and post-construction revegetation (multiple placement locations increases fixed revegetation costs)
	5c. Infrastructure Cost	N	Heavy equipment south of Fanno Creek will require a new bridge ($800,000). Damage to drainage and irrigation pipes in multiple fairways likely require reconstruction $100,000, while repair to damaged cart and maintenance paths about $200,000.
	5d. Implementation Cost	N	About 90 days disruption to golf course for mobilization, set-up, construction and sediment bag placement; 9 months rehabilitation for damage to multiple Fairways.
Other Qualitative Factors	6a. Complete Golf Course	Y	Golf course essential elements will be maintained
	6b. Design Integrity	N	The golf course will design will be damaged
	6c. Drainage	N	Adding sediment between fairways will reduce drainage, harming landscaping
	6d. Accessory Work Areas	Y	No impact to accessory work areas

Onsite Sediment Placement West of Wetland A

The upland area west of Wetland A is approximately 2 times larger than Wetland A. It slopes mostly to the north, but perimeter areas on the west and south also slope toward the surrounding Fanno Creek bike and pedestrian trail. While the preferred sediment bag placement areas is situated in a concave topographic position, this upland area has a convex topographic position. Consequently, it is necessary to grade this upland to have a gentle, east-sloping surface drains to Wetland A. The importance of the east-sloping surface is to capture dredge water seeping from the filled sediment bags, then pump it to Junor Lake. The narrow ditch on the south side of the former electric railroad berm is needed to prevent dredge water from flowing into wetlands adjacent to Fanno Creek (southwest of fairway 15) – it will be blocked by three check dams at this location.

The volume of excavated topsoil will be roughly 1600 cubic yards and an additional 2500 cubic yards removed to create the east-sloping surface. At least 2400 cubic yards of the excavated soil will need to remain onsite and later used to cap the sediment bags (about 1.5 feet thick). If this soil surplus is placed on the neighboring Fairway 15, it will remove golf play before, during and after dredging. The surplus soil cannot remain permanently on Fairway 15, so it will have to be hauled back as cover material for the sediment bags. Consequently, Fairway 15 will need significant rehabilitation for the subsequent year. Specifically, rehabilitation of Fairway 15 will involve reversal of soil compaction (from the weight of stockpiled soils), replacement of underground drainage pipes and irrigation lines, plus regrowth of new turf. This rehabilitation, including short-haul trucking, excavator loading and importing of sand and sod, is estimated at $440,000, as well as loss of revenue due to less desirable playing conditions and inability to host tournaments.

Resultantly, the only location to temporarily stockpile 2400 cubic yards of soil is the adjacent Wetland A, or a small grove of 100-year old Douglas-fir trees. There is private and public opposition to removing the trees, which provide upland habitat for small mammals, song birds, owls, and raptors. The trees also provide a visual resource to the neighborhood to the east and south, shade a portion of the Fanno Creek trail used daily by local enthusiasts and visitors, and are part of the golf course design. Temporary use of Wetland A to stockpile 2400 cubic yards soil will necessitate restoration activities. Restoration of Wetland A will involve excavation, finished grading, seeding and planting for 3 to 5 years; however, no long-term stewardship obligation. It is estimated restoring Wetland A will cost $125,000 for construction and $75,000 for follow-up maintenance and monitoring (to assure ground cover is re-established). Ultimately, this alternative will disturb three times larger an area for the sediment bag placement, and significantly more air pollution due to more equipment hours. When all factors are considered, this is not practicable alternative.

Onsite Sediment Placement West of Wetland A			
Project Criteria		**Met**	**Comments**
Site Size	1a. Water Storage/Supply Size	Y	Utilizes existing Junor Lake
	1b. Sediment Disposal Size	Y	Sediment disposal is possible
Site Availability	2a. Water Storage/Supply Availability	Y	Existing Junor Lake will have adequate water storage capacity once dredging is complete
	2b. Sediment Disposal Availability	Y	The site can be modified to allow sediment disposal, also using Wetland A temporarily for holding excavated soil
Logistics	3a. Water Use Infrastructure	Y	Junor Lake is compatible with existing water use infrastructure
	3b. Construction Ingress/Egress	Y	Dredge equipment access via existing maintenance road connecting S.W. Scholls Ferry Road and interior bridge over Fanno Creek; dredge mobilization on tilt-trailer towed by pickup; sediment bag placement construction access to S.W. 82nd Avenue (crossing Fanno Creek trail)

	3c. Infrastructure Damage Avoidance	Y	Dredge slurry pipes placed atop turf avoids damage to subsurface irrigation and drainage systems in Fairways 13, 14 and 15; steel plating and other measures necessary to protect underground sewer lines and utilities below Fanno Creek trail (no damage to underground infrastructure is permissible).
Environmental Impact	4a. Stream Impacts	N	No impact to Fanno Creek, temporary coffer dam placed in Woods Creek with bypass pipe to isolated flow during dredging
	4b. Stream Functions	N	No impact to Fanno Creek, temporary coffer dam placed in Woods Creek with bypass pipe to isolated flow during dredging
	4c. Wetland Impacts	Y	Preparatory grading in upland will temporarily impact about 80% of Wetland A; emergent fringe of Junor Lake will be reduced by excavation of sediment. Temporary impact to terrestrial Wetland C during excavation phase, but restored after project completion; Wetland B is avoided
	4d. Wetland Functions	Y	Temporary loss of water storage, terrestrial and amphibian habitat, songbird nesting and feeding within Wetland A. Wetland A functions restored after project completion.
	4e. Wildlife Impacts	Y	Most birds and small mammals will be displaced by preparatory grading and sediment bag placement activity (ground disturbance, construction noise and equipment movement)
	4f. Wildlife Functions	Y	Typical nesting, breeding and feeding habitat loss during excavation and sediment placement phase. Except for tree-dependent wildlife, most wildlife functions restored over subsequent decade after project is completed.
	4g. Forest Upland Impacts	N	No impact to upland forests.
	4h. Forest Upland Functions	N	No impact to upland forests.
Cost	5a. Dredge or Excavation and Reservoir Cost	Y	Approx. $400,000 for dredge operations
	5b. Sediment Bag Placement Cost	N	Approx. $250,000 for manufacturing, ground preparation and post-construction revegetation. Additional cost of $300,000 for post-project restoration of Wetland A.
	5c. Infrastructure Cost	Y	Approx. $75,000 for temporary access via S.W. 82nd Avenue, including steel plate covers for sewer lines/utilities
	5d. Implementation Cost	Y	About 10 days disruption to golf course for mobilization, set-up, post-dredging turf restoration; golf course disruption limited to Fairways 7, 11, 13, 14 and 15 for 1 hour durations
Other Qualitative Factors	6a. Complete Golf Course	Y	Golf course essential elements will be maintained
	6b. Design Integrity	Y	The golf course design will be maintained
	6c. Drainage	Y	The golf course's drainage and irrigation will be maintained
	6d. Accessory Work Areas	Y	No impact to accessory work areas

Onsite Sediment Placement in Yard Debris Area

The yard debris area is a critical component of the golf course operations, which is constantly generating leaf litter, trimmed branches, and fallen trees (sawed apart). The yard debris accumulates during fall, winter and spring, then the stockpiles diminish some in summer when organic materials dry and natural oxidize. This area also serves as a storage area for construction materials, surplus dirt and imported gravel, since it has direct access to S.W. 86th Avenue. Mulched materials are stockpiled for several years, depending upon the amount of decomposing wood in such piles. The yard debris area is located north of Fanno Creek and immediately east of S.W. 86th Avenue. It is roughly 0.6-acre, with half on a gentle slope and half on a steep slope toward Fanno Creek. That is, the steep portion is not suitable for sediment bag placement, and flat portion is too small. An additional complication is that yard debris area is composed of fill material ranging from gravel to old branches and tree trunks. It is highly porous material, and it will be extremely difficult to capture dredge seepage that must be pumped back to Junor Lake. Moreover,

the fill material cannot support the sediment placed on top of it and will likely erode the property into Fanno Creek. The golf course also lacks a replacement location for a yard debris area that has similar access to streets where maintenance materials can be loaded and unloaded. Additionally, this location presents a high risk of damage to Fanno Creek if turbid water seeping from the newly filled sediment bags leaked. This location is not well suited for sediment bag placement.

Questions have been raised related to PGC's prior authorization to dispose of sediment in this alternative location. In 1994, PGC hired a contractor to manually suction dredge the bottom of Junor Lake, using scuba diving techniques. The contractor severely underestimated the effort necessary to remove accumulated sediments. It was quickly realized that the scuba diving approach was woefully inefficient and removed relatively little sediment, a couple hundred cubic yards. In particular, the sediment was pumped in a slurry to sediment bags, situated in the vicinity of the landscaping debris yard, located near S.W. 86th Avenue. Several sediment bags were filled after several days, but such progress was slow and had many mechanical difficulties. The debris yard slopes direct toward Fanno Creek, so there was no means of containing the large volume of water draining from the sediment bags. Realizing the sediment removal task was far more technical and substantially greater effort necessary, PGC stopped work to re-evaluate and determine a new approach. The few sediment bags filled were allowed to dry and contents later disposed. The current need requires disposal of 5,300 cubic yards of sediment, which disposal is not practicable in the yard debris area.

Onsite Sediment Placement in Yard Debris Area			
Project Criteria		**Met**	**Comments**
Site Size	1a. Water Storage/Supply Size	Y	Utilizes existing Junor Lake
	1b. Sediment Disposal Size	N	The size of the area is not adequate for both sediment disposal and additional use of the area for yard debris and construction staging
Site Availability	2a. Water Storage/Supply Availability	Y	Existing Junor Lake will have adequate water storage capacity once dredging is complete
	2b. Sediment Disposal Availability	N	The yard debris area is on top of existing fill and cannot be modified to be stable enough for sediment storage nor for capture of dredge drain water
Logistics	3a. Water Use Infrastructure	Y	Junor Lake is compatible with existing water use infrastructure
	3b. Construction Ingress/Egress	Y	Dredge equipment access via existing maintenance road connecting S.W. Scholls Ferry Road and interior bridge over Fanno Creek; dredge mobilization on tilt-trailer towed by pickup; sediment bag placement area has direct access to S.W. 86th Avenue
	3c. Infrastructure Damage Avoidance	Y	Dredge slurry pipes placed atop turf avoids damage to subsurface irrigation and drainage systems in Fairways 13, 14 and 15
Environmental Impact	4a. Stream Impacts	Y	Temporary coffer dam placed in Woods Creek with bypass pipe to isolated flow during dredging. Turbid water will leach through loose, old fill into Fanno Creek.
	4b. Stream Functions	Y	Temporary coffer dam placed in Woods Creek with bypass pipe to isolated flow during dredging. Significant damage to water quality functions in Fanno Creek and risk of accidental sediment release to creek harming fish, invertebrates and downstream properties.
	4c. Wetland Impacts	N	No direct impacts to Wetlands A and B; emergent fringe of Junor Lake would expand to entire lake as sediment accumulates (Wetland C)
	4d. Wetland Functions	N	No loss of wetland functions.
	4e. Wildlife Impacts	N	Only incidental wildlife use of yard debris area, since area is regularly disturbed. No significant impacts.
	4f. Wildlife Functions	N	No loss of wildlife functions..
	4g. Forest Upland Impacts	N	No impact to upland forests.
	4h. Forest Upland Functions	N	No impact to upland forests.

Cost	5a. Dredge or Excavation and Reservoir Cost	Y	Approx. $400,000 for dredge operations
	5b. Sediment Bag Placement Cost	N	Approx. $650,000 for manufacturing, remove old, loose fill, grading, dump truck hauling, and quarry tipping fees.
	5c. Infrastructure Cost	Y	Approx. $75,000 to temporarily relocate yard debris area to alternate location, and post-project restoration of yard debris area.
	5d. Implementation Cost	Y	About 6 days disruption to golf course for mobilization, set-up, post-dredging turf restoration; golf course disruption limited to Fairways 7, 11, 16, 17 and 18 for 1 hour durations
Other Qualitative Factors	6a. Complete Golf Course	Y	Essential elements for golf play will be maintained
	6b. Design Integrity	Y	The golf course design will be maintained
	6c. Drainage	Y	PGC will be able to maintain its irrigated landscaping
	6d. Accessory Work Areas	N	The alternative will destroy the yard debris area

Onsite Sediment Placement in Turf Farm Area

The land immediately north of the yard debris area is used for turf production (aka turf farm). This area amounts to approximately 0.5-acre and it slopes south toward a maintenance path that separates it from the yard debris area. The turf farm is an essential part of the golf course, since there is a perpetual need to replace patchy and worn turf with healthy turf. In addition, ongoing maintenance of irrigation and subsurface drainage systems creates a constant need for replacement turf. While the turf farm area is always needed, it lacks sufficient size to store sediment bags. For example, it will be necessary to stack the sediment bags 4 or 5 high, which is unsafe and risky that the bottom layers could split open. There are no viable places within the PGC to relocate the turf farm, so the sediment would need to be hauled offsite after the excess water has drained off. See alternatives for offsite sediment disposal.

Onsite Sediment Placement in Turf Farm Area			
Project Criteria		**Met**	**Comments**
Site Size	1a. Water Storage/Supply Size	Y	Utilizes existing Junor Lake
	1b. Sediment Disposal Size	N	The size of the area is not adequate for both sediment disposal and additional use of the area for the turf farm
Site Availability	2a. Water Storage/Supply Availability	Y	Existing Junor Lake will have adequate water storage capacity once dredging is complete
	2b. Sediment Disposal Availability	Y	The area can be modified for sediment storage if the turf farm is destroyed
Logistics	3a. Water Use Infrastructure	Y	Junor Lake is compatible with existing water use infrastructure
	3b. Construction Ingress/Egress	Y	Dredge equipment access via existing maintenance road connecting S.W. Scholls Ferry Road and interior bridge over Fanno Creek; dredge mobilization on tilt-trailer towed by pickup; sediment bag placement area has direct access to S.W. 86th Avenue
	3c. Infrastructure Damage Avoidance	Y	Dredge slurry pipes placed atop turf avoids damage to subsurface irrigation and drainage systems in Fairways 13, 14 and 15
Environmental Impact	4a. Stream Impacts	N	No impact to Fanno Creek, temporary coffer dam placed in Woods Creek with bypass pipe to isolated flow during dredging.
	4b. Stream Functions	N	No impact to Fanno Creek, temporary coffer dam placed in Woods Creek with bypass pipe to isolated flow during dredging.
	4c. Wetland Impacts	N	No direct impacts to Wetlands A and B; emergent fringe of Junor Lake would expand to entire lake as sediment accumulates (Wetland C)
	4d. Wetland Functions	N	No loss of wetland functions.
	4e. Wildlife Impacts	N	Only incidental wildlife use of turf farm area, since area is regularly disturbed. No significant impacts.

	4f. Wildlife Functions	N	No loss of wildlife functions..
	4g. Forest Upland Impacts	N	No impact to upland forests.
	4h. Forest Upland Functions	N	No impact to upland forests.
Cost	5a. Dredge or Excavation and Reservoir Cost	Y	Approx. $400,000 for dredge operations
	5b. Sediment Bag Placement Cost	N	Approx. $520,000 for manufacturing, ground preparation, dump truck hauling, and quarry tipping fees. Additional cost of $100,000 for post-project restoration of turf farm
	5c. Infrastructure Cost	Y	Approx. $25,000 for direct purchase of replacement turf for 9 months. About $100,000 for post-project turf farm restoration.
	5d. Implementation Cost	Y	About 6 days disruption to golf course for mobilization, set-up, post-dredging turf restoration; golf course disruption limited to Fairways 7, 11, 16, 17 and 18 for 1 hour durations
Other Qualitative Factors	6a. Complete Golf Course	Y	Essential elements for golf play will be maintained
	6b. Design Integrity	Y	The golf course design will be maintained
	6c. Drainage	N	PGC will not be able to maintain its irrigation of the turf farm
	6d. Accessory Work Areas	N	The alternative will destroy the turf farm area

Onsite Sediment Placement at Driving Range

An alternate location for sediment placement is the driving range, located in the north-center of the golf course (east of the clubhouse). The driving range is surrounded by Fairways 3, 4 and 5. It is an integral component of the golf game, particularly for player warm-up and driving (swing) practice. When a player does not have sufficient time for a 9- or 18-holes of golf, the driving range serves as a 1 or 2 hour substitute. Said differently, the driving range often has greater use than other facilities at the golf course. It cannot be removed to create room for a sediment placement area. From a practicality point of view, the driving range is the farthest distance from Junor Lake, specifically 2000 feet (nearly half a mile). Such distance and upslope position will require two auxiliary pumps to transport the sediment to this location. In addition, use of such area will also require substantial grading to recover seepage water, since the natural topography slopes away from the driving range and ultimately toward Fanno Creek. This location is not available, nor practical for sediment placement.

Onsite Sediment Placement at Driving Range			
Project Criteria		**Met**	**Comments**
Site Size	1a. Water Storage/Supply Size	Y	Utilizes existing Junor Lake
	1b. Sediment Disposal Size	N	The size of the area is not adequate for both sediment disposal and additional use of the area for the driving range
Site Availability	2a. Water Storage/Supply Availability	Y	Existing Junor Lake will have adequate water storage capacity once dredging is complete
	2b. Sediment Disposal Availability	Y	The area can be modified for sediment storage if the driving range is destroyed
Logistics	3a. Water Use Infrastructure	Y	Junor Lake is compatible with existing water use infrastructure
	3b. Construction Ingress/Egress	Y	Dredge equipment access via existing maintenance road connecting S.W. Scholls Ferry Road and interior bridge over Fanno Creek; dredge mobilization on tilt-trailer towed by pickup; sediment bag placement area has indirect access to S.W. 86th Avenue (crosses
	3c. Infrastructure Damage Avoidance	Y	Dredge slurry pipes placed atop turf avoids damage to subsurface irrigation and drainage systems in Fairways 1, 7, 8 and 9
Environmental Impact	4a. Stream Impacts	N	No impact to Fanno Creek, temporary coffer dam placed in Woods Creek with bypass pipe to isolated flow during dredging.
	4b. Stream Functions	N	No impact to Fanno Creek, temporary coffer dam placed in Woods Creek with bypass pipe to isolated flow during dredging.

	4c. Wetland Impacts	N	No direct impacts to Wetlands A and B; emergent fringe of Junor Lake would expand to entire lake as sediment accumulates (Wetland C)
	4d. Wetland Functions	N	No loss of wetland functions.
	4e. Wildlife Impacts	N	Only incidental wildlife use of driving range, since area is disturbed hourly during business hours. No significant wildlife impacts.
	4f. Wildlife Functions	N	No loss of wildlife functions.
	4g. Forest Upland Impacts	N	No impact to upland forests.
	4h. Forest Upland Functions	N	No impact to upland forests.
Cost	5a. Dredge or Excavation and Reservoir Cost	Y	Approx. $450,000 for dredge operations (requires additional pumping to reach driving range in north-center of golf course)
	5b. Sediment Bag Placement Cost	Y	Approx. $150,000 for manufacturing, ground preparation and post-construction revegetation.
	5c. Infrastructure Cost	N	Approx. $375,000 to close driving range for 8 months while area is restored after project completion. Additional cost of $125,000 to temporarily convert turf farm and short game practice area into driving range.
	5d. Implementation Cost	Y	About 6 days disruption to golf course for mobilization, set-up, post-dredging turf restoration; golf course disruption limited to Fairways 7, 11, 16, 17 and 18 for 1 hour durations
Other Qualitative Factors	6a. Complete Golf Course	N	The driving range is an essential feature to the golf course that will be destroyed
	6b. Design Integrity	N	The design of the golf course will be destroyed
	6c. Drainage	N	Irrigated landscaping of the driving range will be destroyed
	6d. Accessory Work Areas	Y	The alternative will maintain accessory work areas

Onsite Sediment Placement in Upland Forest

A potential sediment bag location is an upland forest between fairways 14, 15 and 16. The trees in this vicinity are greater than 100 years old. This dense cluster of older and taller trees provides habitat for numerous bird species, and has perch branches for predator birds. It also has close proximity to Fanno Creek, Woods Creek, and Junor Lake. This wooded grove also serves as a scenic resource for residences located to the west, and is designated as a scenic resource by Washington County, unlike Wetland A. Destruction of this natural resource would also be contrary to PGC's land stewardship policy and golf course design to balance mowed fairways and greens with tree and shrub corridors. Removal of such a natural resource is not supported by PGC, and Washington County is extremely unlikely to approve such resource removal.

Onsite Sediment Bag Placement in Upland Forest			
Project Criteria		**Met**	**Comments**
Site Size	1a. Water Storage/Supply Size	Y	Utilizes existing Junor Lake
	1b. Sediment Disposal Size	Y	The size of the area is adequate for sediment storage
Site Availability	2a. Water Storage/Supply Availability	Y	Existing Junor Lake will have adequate water storage capacity once dredging is complete
	2b. Sediment Disposal Availability	N	PGC will not be able to get Washington County approval to remove the trees to store sediment bags at this location
Logistics	3a. Water Use Infrastructure	Y	Junor Lake is compatible with existing water use infrastructure
	3b. Construction Ingress/Egress	N	Sediment bag containment berm construction is accessible via SW 82nd Ave across Fanno Creek trail; excavation equipment access requires temporary haul road across Fairways 13, 14 and 15. Bridge weight constraints prohibit access via SW 86th Ave. (near maintenance buildings).

	3c. Infrastructure Damage Avoidance	N	Damage will occur to subsurface irrigation and drainage systems and to Fairways 13, 14 and 15; steel plating is necessary to protect underground sewer lines and utilities below Fanno Creek trail
Environmental Impact	4a. Stream Impacts	N	No impact to Fanno Creek, temporary coffer dam placed in Woods Creek with bypass pipe to isolated flow during dredging
	4b. Stream Functions	N	No impact to Fanno Creek, temporary coffer dam placed in Woods Creek with bypass pipe to isolated flow during dredging
	4c. Wetland Impacts	N	Emergent fringe of Junor Lake will be reduced by excavation of sediment. Temporary impact to terrestrial Wetland C during excavation phase, but restored after project completion; Wetlands A and B are avoided
	4d. Wetland Functions	N	Temporary displacement of invertebrate habitat within pond fringe (Wetland C). Increased flood storage in Wetland C.
	4e. Wildlife Impacts	Y	Sediment bag placement will remove trees and low shrub which provide shelter and feeding habitat for songbirds and small mammals.
	4f. Wildlife Functions	Y	Loss of bird and small mammal shelter habitat in trees, as well as reduced travel corridors for wildlife that resides offsite.
	4g. Forest Upland Impacts	Y	Sediment bag placement between trees in forested grove will likely damage and kill mature trees, since bag weight and water seepage compact ground and reduce porosity.
	4h. Forest Upland Functions	Y	Loss of vertical structure, perching and nesting sites for owls, hawks and similar predatory birds.
Cost	5a. Dredge or Excavation and Reservoir Cost	Y	Approx. $300,000 for dredge operations
	5b. Sediment Bag Placement Cost	Y	Approx. $225,000 for manufacturing, tree felling, ground preparation and post-construction re-establishment of forest grove.
	5c. Infrastructure Cost	N	Approx. $50,000 for temporary access via S.W. 82nd Avenue, including steel plate covers for sewer lines/utilities. Damage to drainage and irrigation pipes in multiple fairways likely require reconstruction $150,000, while repair to damaged cart paths about $30,000.
	5d. Implementation Cost	Y	About 10 days disruption to golf course for mobilization, set-up, post-dredging turf restoration; golf course disruption limited to Fairways 7, 11, 13, 14 and 15 for 1 hour durations
Other Qualitative Factors	6a. Complete Golf Course	Y	Interruption with golf course features will be avoided
	6b. Design Integrity	N	The grove of trees is an essential element of the golf course design that will be destroyed
	6c. Drainage	Y	PGC will be able to maintain its irrigated landscaping
	6d. Accessory Work Areas	Y	No impact to accessory work areas

Onsite Sediment Placement in Fairway 15 or Multiple Fairways

Another option for sediment placement is temporary decommissioning of the middle segment of Fairway 15, where it has slopes less than 10 percent. It is the only fairway large enough and logistically positioned to place sediment bags, which will then drain for several months. Next, the sediment bags will be cut open, and the moist sediment spread to dry. The spread-out area will require an area 150 feet wide and 700 feet long, and result in a net ground elevation increase of 1.5 feet. To facilitate drying and reuse as a turf substrate, it will be necessary to use farming equipment to disk into the native soil. That is, the silt sediment is unusable as a topsoil because it is too compressible and highly erodible. Therefore, it must be mixed with the native soil to balance the amount of silt to natural clay loam soil. Such mixing can only be done in 2- to 3-inch lifts. The dredged sediment is so plentiful that it will take 5 lifts to mix the sediment into the native soil. The mixing process will require 2 to 4 weeks per lift, since the silty material is non-cohesive and tends not to form clumps, requiring multiple passes with farming equipment of the entire

volume of sediment. There is insufficient volume of natural soil to mix with the sediment to achieve a suitable soil condition for turf. That is, for each cubic foot of sediment, 4 cubic feet of native soil is needed to achieve the soil structure and low-erosive qualities – that equals roughly 5 feet of native soil. The natural soils in this vicinity have 2 to 3 feet of suitable material, since the substratum is not viable as a growing medium for turf and landscaping.

Lastly, the irrigation and drainage system for Fairway 15 will need to be reconstructed after two rainy seasons (about 18 months) to allow for settling and ground cover stabilization. This approach will not be viable, since the mixed soil materials will be substantially inferior to the native soils and subsurface drainage conditions will be plagued by irregular settling. Without confidence this alternative will work, and given the large disruption to the golf course (and associated revenue and new memberships), this alternative is considered impracticable and experimental.

In discussions with regulatory agencies, it was suggested that PGC place the captured sediment as a thin layer (less than 0.5-inch) atop multiple fairways. This approach anticipates having turf grasses buried by a light application of sediment, then allowing the grasses to grow and sequester the sediment. This approach is akin to having volcanic ash gently burying the land surface and allowing plants to poke upward through the thin layer. This approach still requires the sediment to be pumped into sediment bags and excess water to drain out. When the solids have adhered together (no excess water), the sediment bags will be cut open and a backhoe used to transfer it to small trucks or farm equipment. Such vehicles will drive across flat portions of fairways and other available areas to thinly distribute the sediment. Given that most of the fairways are sloping, it will be precarious to utilize any slope more than 2 percent due to re-mobilization as soon as irrigation or precipitation occurs. Thus, such application will be possible only on portions of Fairways 7, 10, 11, 13, 14, 15, 16, and 18. Assuming ideal weather conditions for such applications, it will take 3 to 4 weeks of turf growth to incorporate the sediment. During such period, these fairways will remain closed. Given the quantity of sediment, this procedure will need to be conducted four times each summer for 4 years, which effectively closes those fairways during peak play times and tournaments. While there are many logistical challenges with this approach, it will also be completely contrary to common turf management practices that seek to have well-aerated soils. PGC has spent decades improving drainage in its soils via aeration, nutrient balance and subsurface drain pipes. The applied silts and clays will immediately fill interstitial pores in the upper part of the soil, resulting in poor infiltration, damaged root zones, and insufficient oxygen to turf grasses. Consequently, one or two applications of sediment will create a patchy turf surface that has higher rates of runoff, and repeatedly burying the grass will kill the grass. Such conditions are simply unacceptable for a golf course and not considered practicable.

Onsite Sediment Placement in Fairway 15 or Multiple Fairways			
Project Criteria		**Met**	**Comments**
Site Size	1a. Water Storage/Supply Size	Y	Utilizes existing Junor Lake
	1b. Sediment Disposal Size	Y	The size of the area is adequate for sediment disposal
Site Availability	2a. Water Storage/Supply Availability	Y	Existing Junor Lake will have adequate water storage capacity once dredging is complete
	2b. Sediment Disposal Availability	N	The area cannot be modified for sediment storage without severely damaging the impacted areas
Logistics	3a. Water Use Infrastructure	Y	Junor Lake is compatible with existing water use infrastructure
	3b. Construction Ingress/Egress	Y	Dredge equipment access via existing maintenance road connecting S.W. Scholls Ferry Road and interior bridge over Fanno Creek; dredge mobilization on tilt-trailer towed by pickup. Farming equipment to spread out sediment can utilize existing bridges over Fanno and Woods Creeks.
	3c. Infrastructure Damage Avoidance	N	Dredge slurry pipes placed atop turf, but sediment bag placement and spreading sediments will severely damage turf. If sediment is tilled into soil at Fairway 15, then irrigation and drainage pipes will need to be replaced.

Environmental Impact	4a. Stream Impacts	N	No impact to Fanno Creek, temporary coffer dam placed in Woods Creek with bypass pipe to isolated flow during dredging
	4b. Stream Functions	N	No impact to Fanno Creek, temporary coffer dam placed in Woods Creek with bypass pipe to isolated flow during dredging
	4c. Wetland Impacts	N	Emergent fringe of Junor Lake will be reduced by excavation of sediment. Temporary impact to terrestrial Wetland C during excavation phase, but restored after project completion; Wetlands A and B are avoided
	4d. Wetland Functions	N	Temporary displacement of invertebrate habitat within pond fringe (Wetland C). Increased flood storage in Wetland C.
	4e. Wildlife Impacts	N	No impact to wildlife.
	4f. Wildlife Functions	N	No loss of wildlife functions..
	4g. Forest Upland Impacts	N	No impact to upland forests.
	4h. Forest Upland Functions	N	No impact to upland forests.
Cost	5a. Dredge or Excavation and Reservoir Cost	Y	Approx. $400,000 for dredge operations
	5b. Sediment Bag Placement Cost	Y	Approx. $100,000 for manufacturing and ground preparation (must create water catchment berm).
	5c. Infrastructure Cost	N	Approx. $325,000 to transport the sequestered sediment to one or more fairways, then rehabilitate turf where damaged by sediment bag placement and spreading out sediment. Given potential long-term damage to turf condition, PGC may expend an additional $200,000 rehabilitating fairways where sediment was placed.
	5d. Implementation Cost	N	4 to 5 fairways become inoperable when sediment bags placed, then later spread out on turf. Rehabilitation time is estimated at 6 to 8 months, which makes course unviable.
Other Qualitative Factors	6a. Complete Golf Course	N	This option removes essential elements of the golf course
	6b. Design Integrity	N	The golf course design will no longer be suitable for golf play or tournaments
	6c. Drainage	N	Irrigated landscaping and drainage for landscaping health will be destroyed
	6d. Accessory Work Areas	Y	The alternative will maintain accessory work areas

Offsite Quarry Sediment Placement Alternative

Sediment placement at a quarry site was examined, which will involve hauling the sediment captured in the sediment bags offsite. Quarries commonly accept clean fill material to backfill previously-mined areas (for future reclamation). Like traditional fill operations, quarries accept clean soil and that soil can be delivered in dump trucks once it is solid material. To attain solid-like consistency, excess water must first drain out of the sediment bags, then it can be loaded into dump trucks. At least a year is needed to remove the excess water from the sequestered sediment. The most suitable location is Wetland A, which has a natural configuration to capture drain water. Since the filled sediment bags are too heavy to lift individually, each bag will be cut open, then sediment loaded by backhoe into dump truck. The anticipated number of truck loads is 550 to 600 (assuming 12 cubic yard capacity).

There are several quarries in their late stages of mining and/or already in their reclamation phase in the vicinity of S.W. Tonquin Road and S.W. Morgan Road (23 miles away), about 2 miles south of Sherwood and 3 miles southwest of Tualatin. This vicinity is approximately 14 miles south by southwest of Portland Golf Club (45- to 60-minute roundtrip travel). This vicinity is more desirable than quarries in the Cooper Mountain area and Burlington area, since it is closer; the travel route is mostly on highways/arterials; and will cause a lesser impact on neighborhoods. A highway travel route has wider, safer roads, better visibility (especially for loaded trucks), and heavier-duty construction. The only available travel route will be via S.W. 82nd Avenue, then S.W. Garden Home Road and S.W. Oleson Road to Oregon Highway 217. While it is not preferred to drive dump trucks through residential

neighborhoods with narrow streets, it is the only access route available for this activity (no road through the golf course, for example). Such route dramatically increases the risk of damaging underground sewer lines under the Fanno Creek trail – this is unacceptable risk for PGC, as well as the adjacent neighborhood and downgradient Fanno Creek floodplain.

The trucking time is approximately 7 trips per truck per day (including 1 hour lunch) to the nearest, available quarry. The excavator is capable of filling 4 trucks per hour; therefore, about 28 trucks per day will haul the sediment to the nearest, available quarry site. Given weekends, holidays and mechanical difficulties, the sediment hauling is estimated to span approximately 5 weeks. Recent inflation has substantially increased the expected loading and hauling cost to $350,000, plus an additional dumping cost of roughly $115,000. There will also be labor and support equipment costs (such as flaggers, street sweeping, etc.) that add another estimated $55,000. Lastly, project completion and restoring Wetland A will be $125,000 for construction and $75,000 for follow-up maintenance and monitoring (to assure ground cover is re-established). Added together, the option to haul the sediment offsite to a quarry will cost approximately $720,000. Such cost is substantially higher than the cost of the proposed alternative. The project team considered this supplemental hauling, and disposal cost impracticable.

Please note, golf balls exist in the sediment that will be dredged, and the golf balls will not be removed by the dredging process. As such, the dredged material does not meet the definition of "clean fill" under OAR 340-093-0030(18), and cannot therefore be disposed at a quarry or construction site. OAR 340-093-0040(1). PGC is aware of its responsibility to handle and dispose of the golf balls as required by law, and will work with the Oregon Department of Environmental Quality to ensure proper disposal based on its permits issued by the USACE and DSL in this JPA process. As such, PGC has analyzed offsite quarry sediment placement, but the alternative is ultimately not possible.

Offsite Quarry Sediment Placement			
Project Criteria		**Met**	**Comments**
Site Size	1a. Water Storage/Supply Size	Y	Utilizes existing Junor Lake
	1b. Sediment Disposal Size	Y	Sediment disposal volume is possible
Site Availability	2a. Water Storage/Supply Availability	Y	Existing Junor Lake will have adequate water storage capacity once dredging is complete
	2b. Sediment Disposal Availability	N	A quarry cannot accept the dredged material as clean fill
Logistics	3a. Water Use Infrastructure	Y	Junor Lake is compatible with existing water use infrastructure
	3b. Construction Ingress/Egress	Y	Dredge equipment access via existing maintenance road connecting S.W. Scholls Ferry Road and interior bridge over Fanno Creek; dredge mobilization on tilt-trailer towed by pickup; sediment bag placement construction access to S.W. 82nd Avenue (crossing Fanno Creek trail)
	3c. Infrastructure Damage Avoidance	Y	Dredge slurry pipes placed atop turf avoids damage to subsurface irrigation and drainage systems in Fairways 13, 14 and 15; steel plating and other measures necessary to protect underground sewer lines and utilities below Fanno Creek trail (no damage to underground infrastructure is permissible).
Environmental Impact	4a. Stream Impacts	N	No impact to Fanno Creek, temporary coffer dam placed in Woods Creek with bypass pipe to isolated flow during dredging
	4b. Stream Functions	N	No impact to Fanno Creek, temporary coffer dam placed in Woods Creek with bypass pipe to isolated flow during dredging
	4c. Wetland Impacts	Y	Sediment bag placement will temporarily impact Wetland A; emergent fringe of Junor Lake replaced with open water and adjacent terrestrial Wetland C avoided; higher functioning Wetland B is avoided
	4d. Wetland Functions	Y	No permanent impact to Fanno or Woods Creeks. Wetland A would temporarily lose water storage and desynchronization functions, as well as sediment trapping, wildlife and amphibian habitat, and songbird habitat.

	4e. Wildlife Impacts	Y	Temporary filling of Wetland A will displace breeding, nesting and feeding habitat for wetland-dependent songbirds, small mammals, and amphibians. Temporary displacement of invertebrate habitat within pond fringe (Wetland C).
	4f. Wildlife Functions	Y	Temporary loss of wildlife functions will be restored after project completion and wetland rehabilitation.
	4g. Forest Upland Impacts	N	No impact to upland forests
	4h. Forest Upland Functions	N	No impact to upland forests
Cost	5a. Dredge or Excavation and Reservoir Cost	Y	Approx. $400,000 for dredge operations
	5b. Sediment Bag Placement Cost	N	Approx. $520,000 for manufacturing, ground preparation, dump truck hauling, and quarry tipping fees. Additional cost of $200,000 for post-project restoration of Wetland A.
	5c. Infrastructure Cost	Y	Approx. $75,000 for temporary access via S.W. 82nd Avenue, including steel plate covers for sewer lines/utilities
	5d. Implementation Cost	Y	About 10 days disruption to golf course for mobilization, set-up, post-dredging turf restoration; golf course disruption limited to Fairways 7, 11, 13, 14 and 15 for 1 hour durations
Other Qualitative Factors	6a. Complete Golf Course	Y	Golf course elements will be maintained
	6b. Design Integrity	Y	The golf course design will be maintained
	6c. Drainage	Y	The golf course's drainage and irrigation will be maintained
	6d. Accessory Work Areas	Y	No impact to accessory work areas

Offsite Traditional Sediment Placement Alternative

Another alternative for sediment disposal is hauling it offsite as construction fill. Traditional fill sites, like quarry fill sites, require clean material that can be piled and later re-worked with bulldozers and blade graders. The quarry sediment placement alternative describes the excavation and hauling process, including utilizing Wetland A for temporary sediment bags placement (drain off excess water, then offsite hauling). Assuming a similar haul distance as the quarry sediment placement alternative, this alternative may not have a dump or "tipping" fee, however, as predominantly silt material, it would be difficult to find someone to accept it. Specifically, the sediment is highly compressible and requires substantially extra work to mix it with other soil that has greater soil strength and more consistently has a firmness suitable for building atop. It is unlikely a property owner or contractor would accept this material as fill due to its compressible attributes, presence of golf balls, and large volume. Given these limitations (both cost and feasibility), traditional clean fill sites are not viable.

Offsite Traditional Sediment Placement			
Project Criteria		**Met**	**Comments**
Site Size	1a. Water Storage/Supply Size	Y	Utilizes existing Junor Lake
	1b. Sediment Disposal Size	Y	Sediment disposal volume is possible
Site Availability	2a. Water Storage/Supply Availability	Y	Existing Junor Lake will have adequate water storage capacity once dredging is complete
	2b. Sediment Disposal Availability	N	A construction site cannot accept the material as clean fill
Logistics	3a. Water Use Infrastructure	Y	Junor Lake is compatible with existing water use infrastructure
	3b. Construction Ingress/Egress	Y	Dredge equipment access via existing maintenance road connecting S.W. Scholls Ferry Road and interior bridge over Fanno Creek; dredge mobilization on tilt-trailer towed by pickup; sediment bag placement construction access to S.W. 82nd Avenue (crossing Fanno Creek trail)
	3c. Infrastructure Damage Avoidance	N	Dredge slurry pipes placed atop turf avoids damage to subsurface irrigation and drainage systems in Fairways 13, 14 and 15; steel plating and other measures necessary to protect underground sewer lines and utilities below Fanno Creek trail (no damage to underground infrastructure is permissible).

Environmental Impact	4a. Stream Impacts	N	No impact to Fanno Creek, temporary coffer dam placed in Woods Creek with bypass pipe to isolated flow during dredging
	4b. Stream Functions	N	No impact to Fanno Creek, temporary coffer dam placed in Woods Creek with bypass pipe to isolated flow during dredging
	4c. Wetland Impacts	Y	Sediment bag placement will temporarily impact Wetland A; emergent fringe of Junor Lake replaced with open water and adjacent terrestrial Wetland C avoided; higher functioning Wetland B is avoided
	4d. Wetland Functions	Y	No permanent impact to Fanno or Woods Creeks. Wetland A would temporarily lose water storage and desynchronization functions, as well as sediment trapping, wildlife and amphibian habitat, and songbird habitat.
	4e. Wildlife Impacts	Y	Temporary filling of Wetland A will displace breeding, nesting and feeding habitat for wetland-dependent songbirds, small mammals, and amphibians. Temporary displacement of invertebrate habitat within pond fringe (Wetland C).
	4f. Wildlife Functions	Y	Temporary loss of wildlife functions will be restored after project completion and wetland rehabilitation.
	4g. Forest Upland Impacts	N	No impact to upland forests
	4h. Forest Upland Functions	N	No impact to upland forests
Cost	5a. Dredge or Excavation and Reservoir Cost	Y	Approx. $400,000 for dredge operations
	5b. Sediment Bag Placement Cost	N	Approx. $600,000 for manufacturing, ground preparation, dump truck hauling to construction site, and post-construction revegetation
	5c. Infrastructure Cost	Y	Approx. $75,000 for temporary access via S.W. 82nd Avenue, including steel plate covers for sewer lines/utilities
	5d. Implementation Cost	Y	About 10 days disruption to golf course for mobilization, set-up, post-dredging turf restoration; golf course disruption limited to Fairways 7, 11, 13, 14 and 15 for 1 hour durations
Other Qualitative Factors	6a. Complete Golf Course	Y	Golf course elements will be maintained
	6b. Design Integrity	Y	The golf course design will be maintained
	6c. Drainage	Y	The golf course's drainage and irrigation will be maintained
	6d. Accessory Work Areas	Y	No impact to accessory work areas

Summary of Alternatives

The project team for Portland Golf Club evaluated 19 alternative scenarios, ranging from no-action, replacement golf course, new irrigation pond or reservoir, sediment placement in Wetland A or Wetland B, sediment placement within golf course fairways or driving range, and several variations of these alternatives. Five alternatives were immediately rejected for exorbitant cost ($4M to $40M). The excavation of loose sediment alternative and sediment placement in Wetland B alternative were also immediately rejected due to greater environmental impact. The removal of mature upland forest (>100 year old trees) was rejected for significant loss of wildlife habitat and valuable design resource for golf course. Four alternatives were rejected on basis of significantly disrupting golfing play by closure of fairway(s) or driving range for 9 to 12 months, as well as exceeding $1M expense. Two alternatives were dismissed because sediment bag placement would severely interrupt golf course maintenance, as well as exceeding $1M expense. An alternative to remove only half of the accumulated sediment and remove smaller amounts over several decades was rejected for more than doubling the project cost, but having the same environmental impacts. Two alternatives that would temporarily store the sediment in Wetland A, then later transport offsite were not practicable, since hauling costs add a minimum of $500,000 to the project expense. And another alternative that would temporarily store salvaged soil in Wetland A, then later cover sediment bags was not practicable since disturbs 2 times larger area and it doubled the project cost. The following table summarizes each alternative, estimated cost and reason(s) for rejecting such alternative.

Alternative	Estimated Cost	Rejection Rationale
No-Action	$25 million	Loss of irrigation water storage in Junor Lake would result in golf course closure. Not financially viable alternative.
Sediment Excavation, loose material placement in Wetland A	$950,000	Impacts Wetland A, large cost to build haul road across 3 fairways, then restore afterwards. Temporary closure of 3 fairways for 9 months. Significant disruption of golf course operations (player activity). Not financially viable alternative.
Periodic Dredging, sediment bag placement in Wetland A.	$1.35 million	Initial impacts 0.4-acre of Wetland A; however, future dredging ultimately fills entire wetland. Repeated costs for two additional dredging within 30 years. Not financially viable alternative.
Replacement Golf Course	$40 million	Not financially viable alternative.
Replacement Irrigation Pond	$1.5 million	Impacts Wetland A with excess spoils from new pond excavation. Temporary closure of 3 fairways for 9 months during pond excavation and post-project fairway restoration. Not financially viable alternative.
Metal or Concrete Reservoir(s)	$4.2 million	Partial impact to Wetland A due to size of reservoir(s). Restoration of damaged fairway irrigation and drainage systems. Not financially viable alternative.
Well and Domestic Water Source	$6.7 million	Unstable water source and extensive construction to bring new water source to golf course. Not financially viable alternative.
Recycled Water Source	$9.2 million	Water source not currently available and extensive construction to bring recycled water source to golf course. Not financially viable alternative.
Temporary Sediment Bag Placement at Wetland, Haul sediment to quarry	$1.2 million	Temporary impact to Wetland A, then later haul away sediment to quarry. Post-project restoration of Wetland A. Not financially viable alternative.
Temporary Sediment Bag Placement at Wetland A, Haul sediment to offsite location	$1.1 million	Temporary impact to Wetland A, then later haul away sediment to undetermined location. Unlikely to find land owner or contractor to accept silty material with golf balls. Post-project restoration of Wetland A. Not financially viable alternative.
Sediment Bag Placement at Yard Debris Area	$1.2 million	Small area requires removal of loose, old fill material, then later haul away sediment to restore land back to yard debris area. Significant disruption of golf course maintenance activities. Not financially viable alternative.
Sediment Bag Placement at Turf Farm Area	$1.1 million	Temporary impact to turf farm, then later haul away sediment to restore land back to turf farm. Significant disruption of golf course maintenance activities. Not financially viable alternative.

Sediment Bag Placement at Driving Range	$950,000	Driving range temporarily relocated to turf farm and short game practice area. Driving range reconstructed after sediment spread out. Replacement of irrigation and drainage systems. Significant disruption of golf course operations (player activity). Not financially viable alternative.
Sediment Bag Placement at Fairway 15 or multiple fairways	$1.1 million	1 to 3 fairways closed for at least 1 year for sediment placement, then fairway reconstructed after sediment spread out. Replacement of irrigation and drainage systems. Significant disruption of golf course operations (player activity). Not financially viable alternative.
Sediment Bag Placement at Upland Forest	$725,000	Destruction of mature, 100-year old trees, loss of wildlife habitat, loss of golf course design element. Impact to adjacent neighborhood quality of life.
Sediment Bag Placement west of Wetland A	$1.1 million	Temporary impact to Wetland A for overburden storage, then post-project wetland restoration. Disturbs 2 times larger area than other alternatives. Not financially viable alternative.
Sediment Bag Placement between Fairways	$1.6 million	Requires Fanno Ck. bridge replacement, construction of multiple disposal sites, removal of large trees. Significant disruption of golf course operations (player activity). Not financially viable alternative.
Sediment Bag Placement in Wetland B	$1.3 million	Requires Fanno Ck. bridge replacement, loss of forested wetland, loss of floodplain storage. Not financially viable alternative.
Sediment Bag Placement in Wetland A	$550,000	Not rejected. Preferred alternative has less wetland impact than Wetland B alternative. Less ground disturbance, and least disruption to golf course activities and maintenance operations.

Mitigation Analysis

Mitigation cannot be used as a method to reduce environmental impacts in the evaluation of alternatives. Thus, this section addresses the Applicant's proposed mitigation of environmental impacts from the least environmentally damaging practicable alternative identified above.

In accordance with State and Federal Mitigation Rules, mitigation is best accomplished for this project via purchase of credits from an established wetland mitigation bank. Applicant responsible compensatory mitigation (onsite wetland replacement) is not economically, spatially, or environmentally feasible. As such, Applicant's team analyzed potential purchase of credits from agency-approved Butler Mitigation Bank.

As per principal objectives for Compensatory Wetland Mitigation (CWM), the mitigation credit purchase will satisfy the following objectives:

A) Replacing wetland functions and values lost at the impact site – The mitigation bank site has wetland functions and values that are greater, namely: 1) moderate to high wildlife/bird habitat and

hydraulic functioning and value (due to plant diversity, habitat maturation, proximity to Tualatin River); 2) preferrable mitigation bank location, which is located away from urban development and stressors; 3) the mitigation bank possess moderate to high terrestrial habitat value (particularly for mammals and birds, and 4) mitigation bank exhibits similar hydrologic characteristics (mostly precipitation-driven seasonal wetlands, HGM-Slope). There is no ORWAP score from Butler Mitigation Bank to compare to the ORWAP score for Wetland A.

B) Providing local replacement of said functions and values – The impact to Wetland A is within the service area of the mitigation bank site, which provides local replacement of wetlands in the Tualatin Valley.

C) Providing self-sustaining wetland with minimal long-term maintenance – The mitigation bank site has achieved target functioning, which requires minimal maintenance. Long-term stewardship is a component of the mitigation bank obligations. Onsite or nearby mitigation (same vicinity as development) will be adversely affected by existing adjacent urban development and ongoing golfing activities/maintenance.

The proposed sediment bag placement will permanently impact 0.72-acre of wetland, which best qualifies as Palustrine, Emergent wetland (PEM) Cowardin and Slopes / Flat (S/F) Oregon Hydrogeomorphic (OHGM) classification. To more fully replace function and value lost by the proposed development, and as guided by DSL's *Compensatory Mitigation Eligibility and Accounting Determination Form*, purchase of PEM credits is deemed the environmentally superior strategy. Therefore, this is the preferred mitigation approach.

Conclusion

To restore capacity to Junor Lake, PGC has thoroughly evaluated numerous alternatives, including no-action, offsite sediment transport, recycled water use, and sediment bag placement. While PGC initially proposed sediment excavation and placement in Wetland A, further analysis found an environmentally preferrable solution to dredge accumulated sediments and sequester in sediment bags. The most suitable location is Wetland A due to site constraints, logistics, environmental impacts, cost, and the project purpose, which requires maintaining the PGC property as a world renowned golf course. The impact to Wetland A will be offset with a purchase of 0.72-acre PEM credits from Butler Mitigation Bank. Such purchase assures no net loss of wetland acreage, plus no loss of wetland function and value. In fact, the wetland function and value maintained through the mitigation bank purchase will exceed that in Wetland A.

The preceding Least Environmental Damaging Practicable Alternative (LEDPA) analysis documents this decision-making process and provides transparency for the rationale in selecting the preferred alternative. Specifically, the LEDPA analysis concluded that onsite excavation will result in greater environmental damage than sediment bag placement (which has a smaller, less invasive impact). Additionally, the sediment bag replacement approach will be environmentally preferrable than hauling over 600 truckloads of sediment to a rock quarry as fill (not currently allowed due to presence of inert golf balls within the sediment). The sediment bag placement approach will satisfy PGC's need to restore water storage capacity in Junor Lake, minimize golf play interruption, and minimize damage to essential golf infrastructure. While all of the alternatives are expensive, the preferred alternative utilizes less equipment, disturbs less ground, and makes use of natural topography to minimize environmental impacts. The preferred alternative also minimizes impacts to adjacent neighborhoods, avoids damage to an mature groves of Douglas-fir; and recycles water back to Junor Lake. This approach meets all of the project criteria; whereas, the rejected alternatives fail to meet several criteria and often have the same (or similar) environmental impact.

PGC Prior Dredge Sediment Bag Placement Photographs (October 2023)

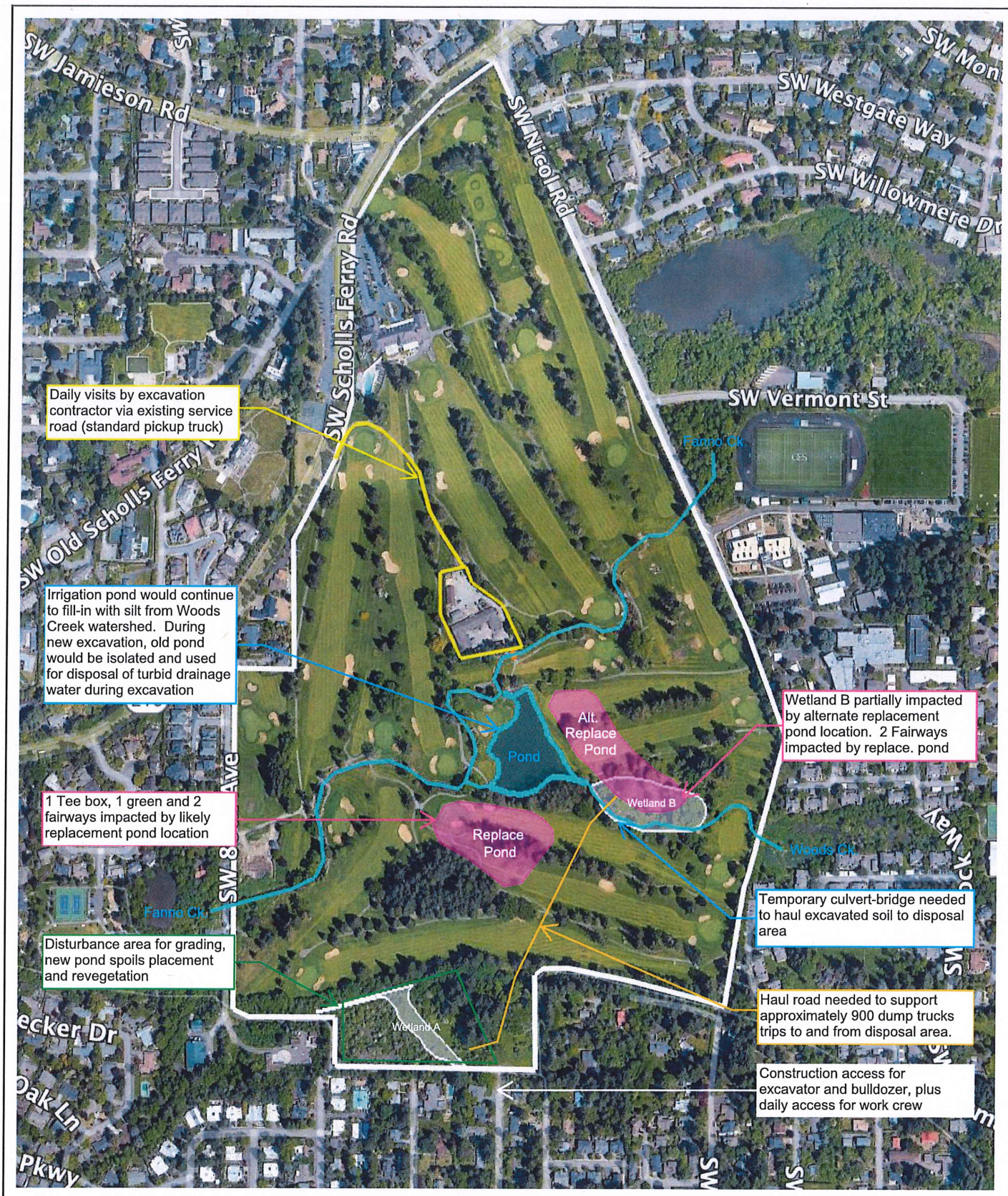
View south at area used for sediment bag storage (foreground) and dredge equipment staging (background near vehicles). Prior dredging attempt (circa 1990s) was not successful because dredging equipment was too small to handle large volume of sediment accumulated in irrigation pond.

Plan view of area previously used for dredge equipment staging and sediment bag storage, circa 1990s (yellow outline). This location has an access gate to S.W. 86th Avenue.

PGC Prior Dredge Sediment Bag Placement Photographs (Con't.)

View north at area used for sediment bag placement during prior attempt removing sediment from irrigation pond (circa 1990s). This area is part of the turf farm (new turf growing at far left).

View northwest at staging area (foreground) and sediment bag placement area (background). Yard debris is temporarily stored, processed and composted in foreground area, while turf grown in background area.



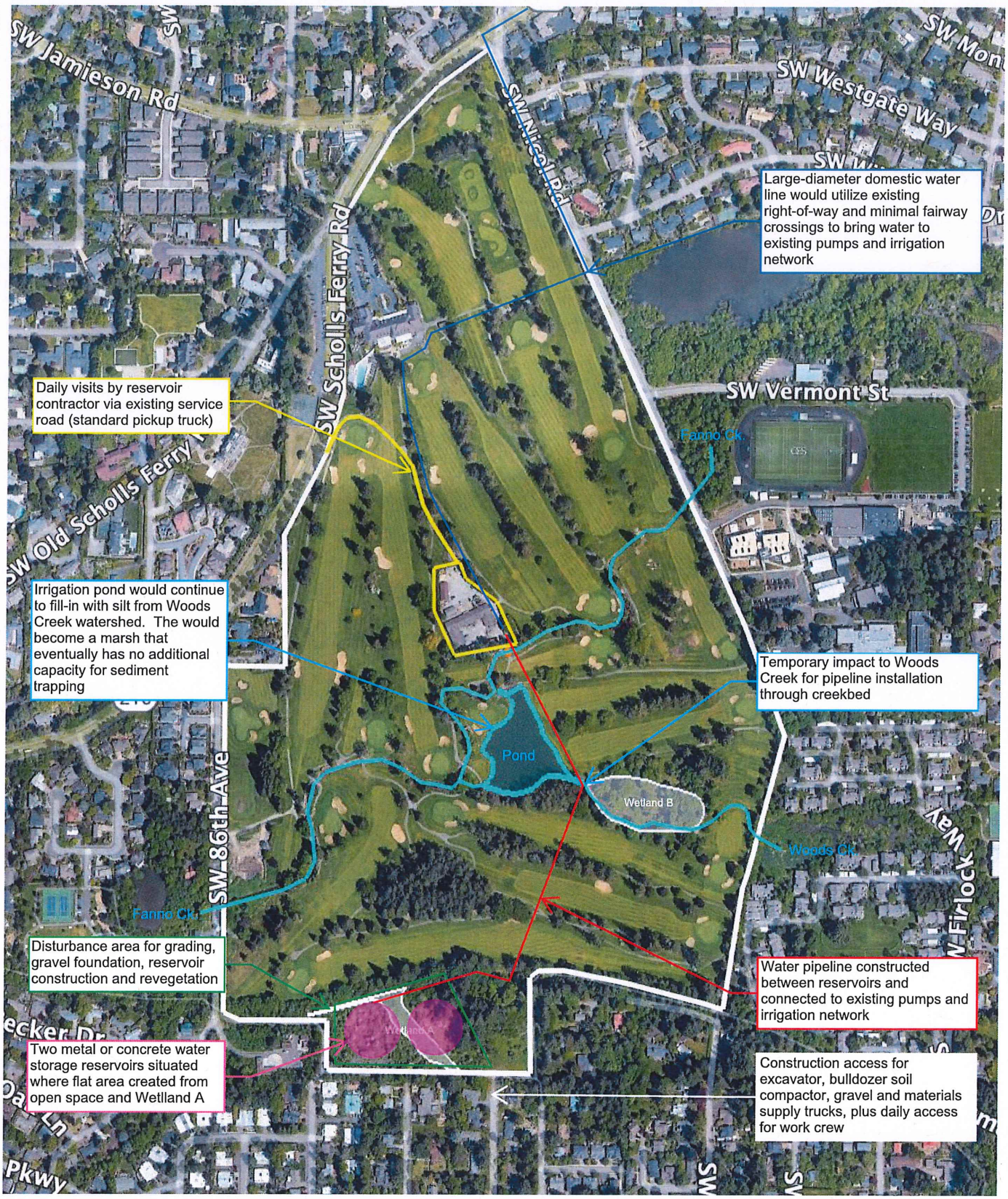
Terra Science, Inc.
Soil, Water & Wetland Consultants

GRAPHIC SCALE
0 ft. 400 ft. 800 ft.

ALTERNATIVES ANALYSIS FOR PORTLAND GOLF CLUB
IRRIGATION POND SEDIMENT REMOVAL AND PLACEMENT
Portion of TAX LOT 1700, T. 1S, R. 1W, Sec. 24 (BC)
Washington County, Oregon

June 2023

REPLACEMENT POND ALTERNATIVE



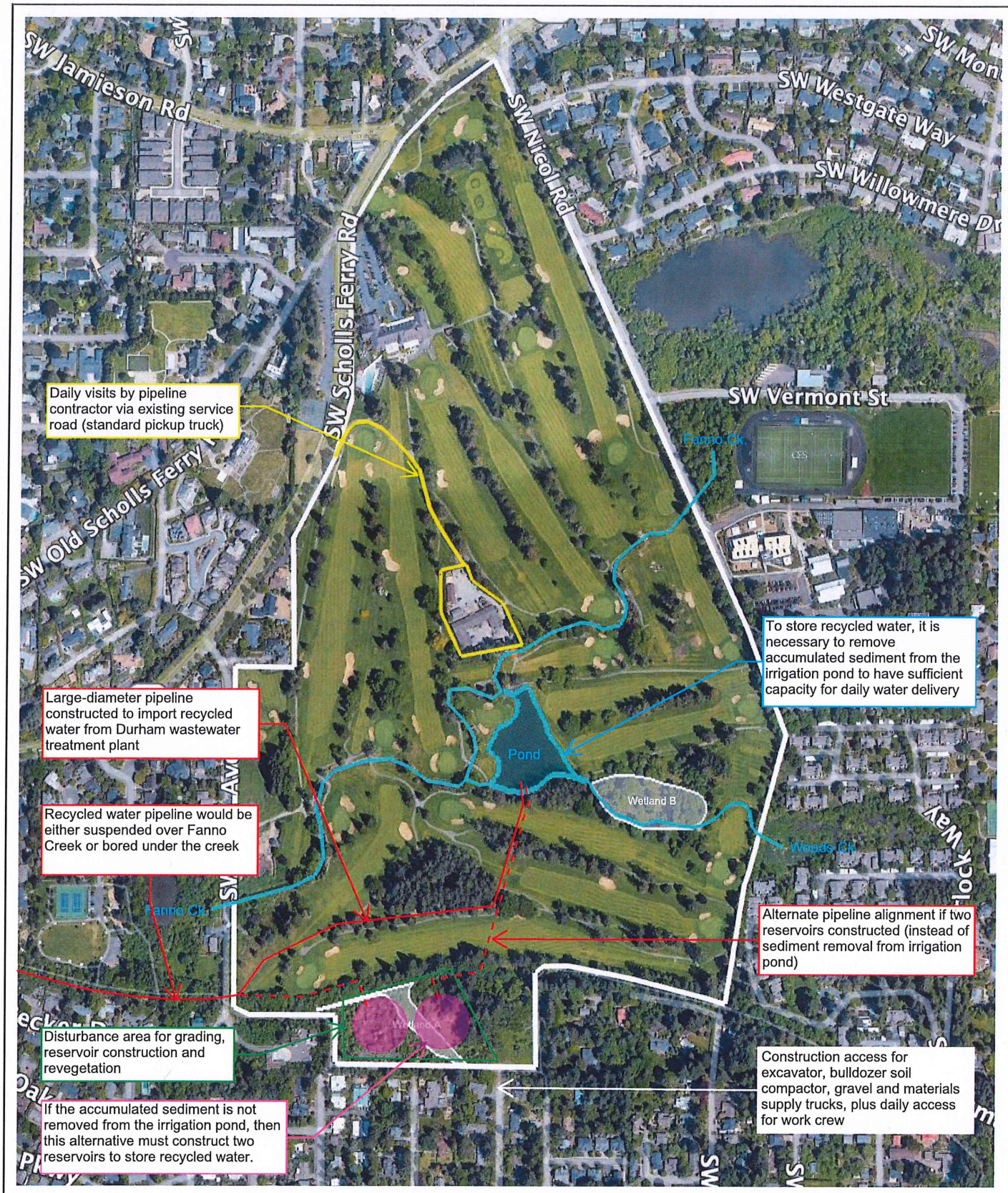
Terra Science, Inc.
Soil, Water & Wetland Consultants

GRAPHIC SCALE
0 ft. 400 ft. 800 ft.

ALTERNATIVES ANALYSIS FOR PORTLAND GOLF CLUB
IRRIGATION POND SEDIMENT REMOVAL AND PLACEMENT
Portion of TAX LOT 1700, T. 1S, R. 1W, Sec. 24 (BC)
Washington County, Oregon

June 2023

METAL OR CONCRETE
RESERVOIR AND
DOMESTIC WATER
SOURCE ALTERNATIVES



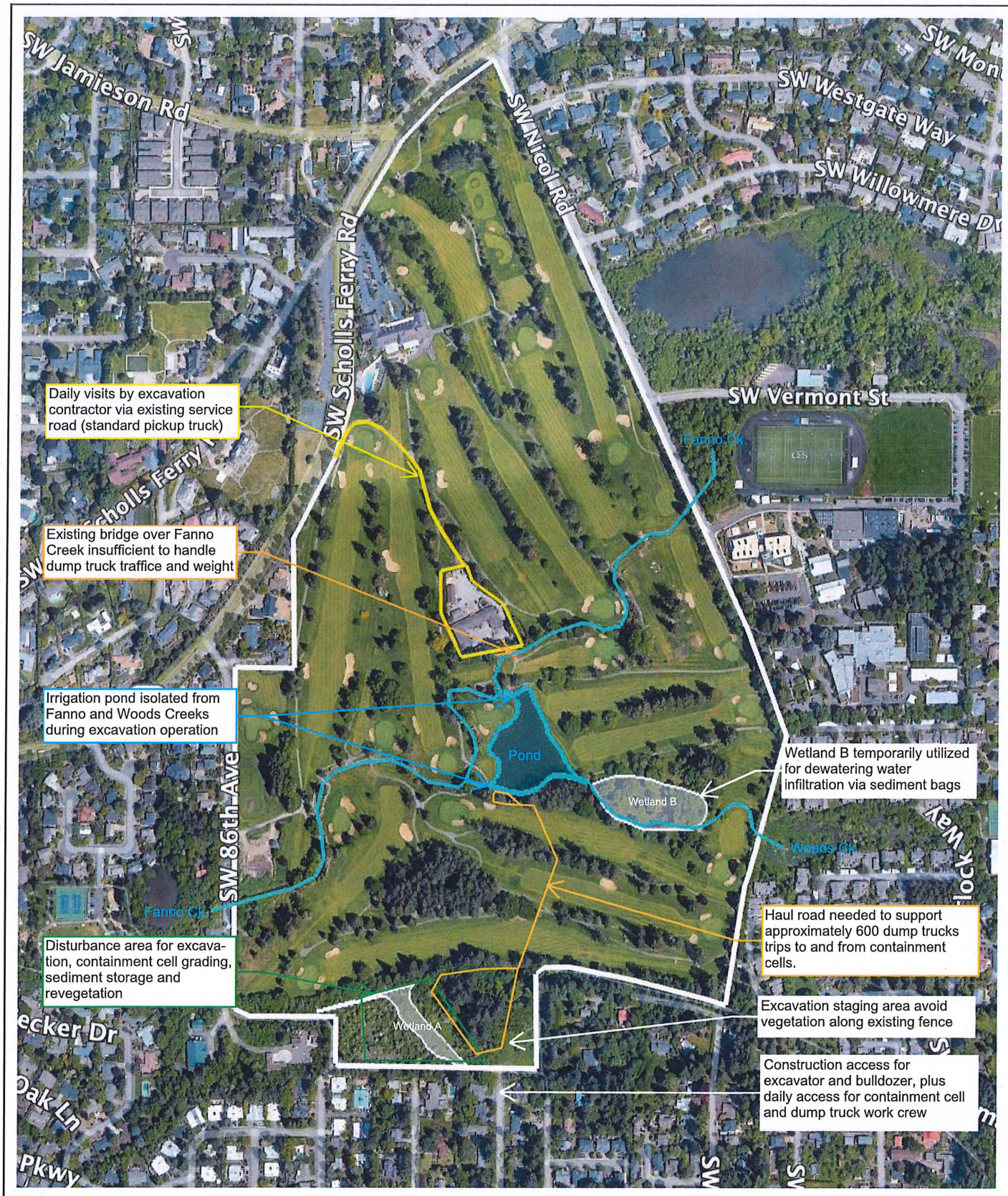
Terra Science, Inc.
Soil, Water & Wetland Consultants

GRAPHIC SCALE
0 ft. 400 ft. 800 ft.

ALTERNATIVES ANALYSIS FOR PORTLAND GOLF CLUB
IRRIGATION POND SEDIMENT REMOVAL AND PLACEMENT
Portion of TAX LOT 1700, T. 1S, R. 1W, Sec. 24 (BC)
Washington County, Oregon

June 2023

RECYCLED WATER SOURCE ALTERNATIVE



Terra Science, Inc.
Soil, Water & Wetland Consultants

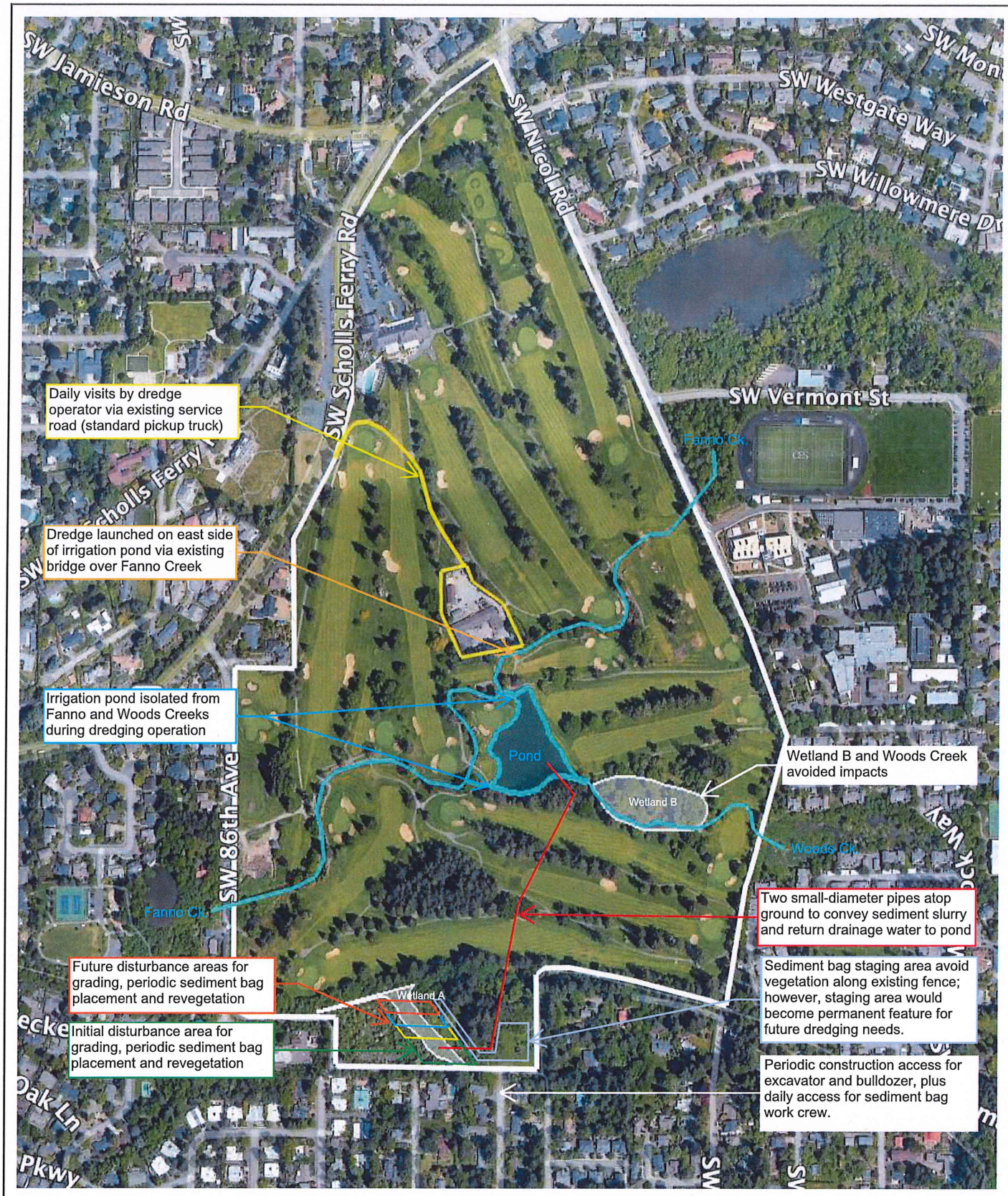
GRAPHIC SCALE

0 ft. 400 ft. 800 ft.

ALTERNATIVES ANALYSIS FOR PORTLAND GOLF CLUB
IRRIGATION POND SEDIMENT REMOVAL AND PLACEMENT
Portion of TAX LOT 1700, T. 1S, R. 1W, Sec. 24 (BC)
Washington County, Oregon

June 2023

SEDIMENT EXCAVATION ALTERNATIVE



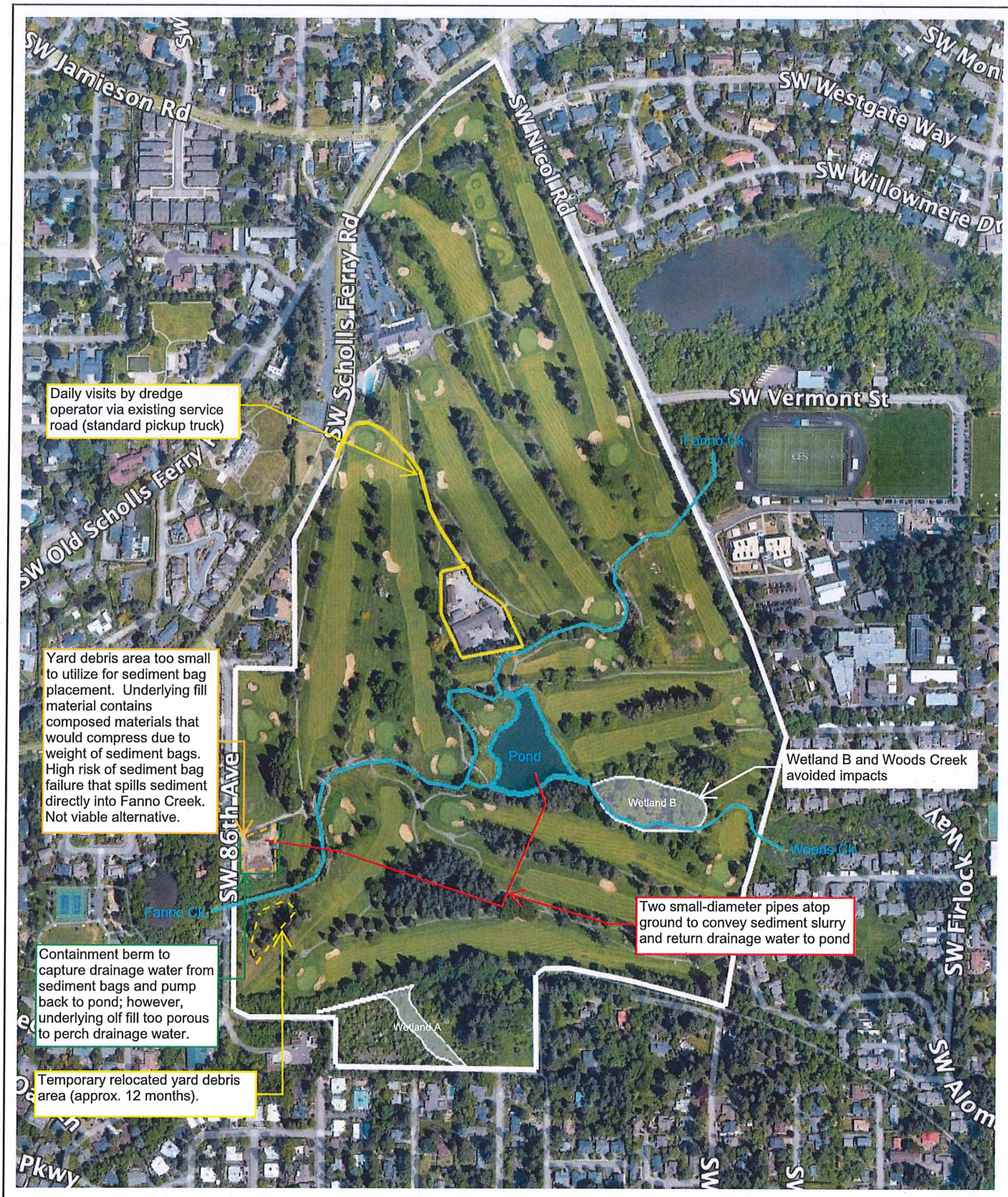
Terra Science, Inc.
Soil, Water & Wetland Consultants

GRAPHIC SCALE
0 ft. 400 ft. 800 ft.

ALTERNATIVES ANALYSIS FOR PORTLAND GOLF CLUB
IRRIGATION POND SEDIMENT REMOVAL AND PLACEMENT
Portion of TAX LOT 1700, T. 1S, R. 1W, Sec. 24 (BC)
Washington County, Oregon

October 2023

PERIODIC (REDUCED) DREDGING AND SEDIMENT BAG PLACEMENT ALTERNATIVE



Terra Science, Inc. Soil, Water & Wetland Consultants	ALTERNATIVES ANALYSIS FOR PORTLAND GOLF CLUB IRRIGATION POND SEDIMENT REMOVAL AND PLACEMENT Portion of TAX LOT 1700, T. 1S, R. 1W, Sec. 24 (BC) Washington County, Oregon October 2023	YARD DEBRIS AREA SEDIMENT BAG PLACEMENT ALTERNATIVE
GRAPHIC SCALE 0 ft. 400 ft. 800 ft.		

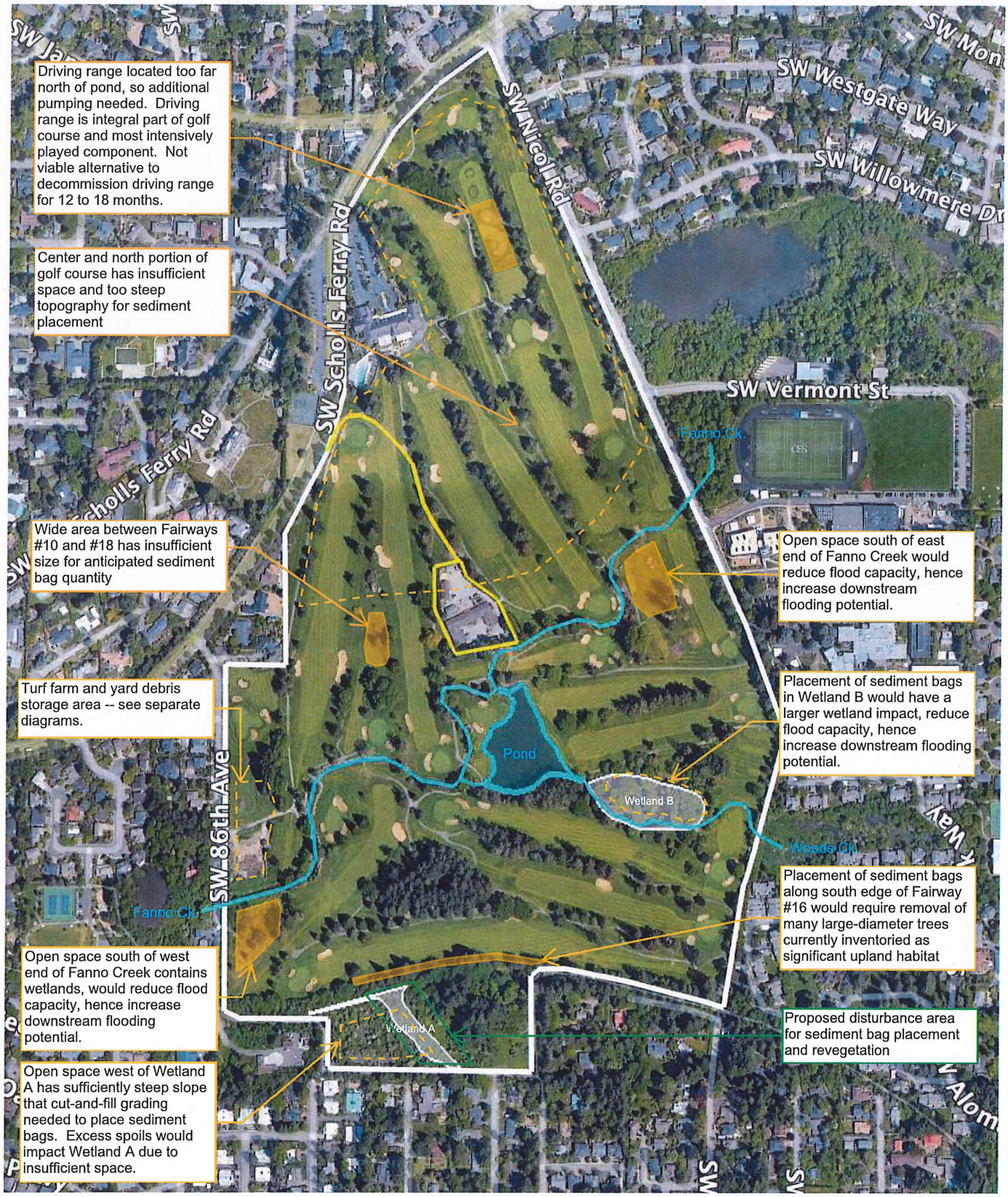
Terra Science, Inc.
Soil, Water & Wetland Consultants

GRAPHIC SCALE
0 ft. 400 ft. 800 ft.

ALTERNATIVES ANALYSIS FOR PORTLAND GOLF CLUB
IRRIGATION POND SEDIMENT REMOVAL AND PLACEMENT
Portion of TAX LOT 1700, T. 1S, R. 1W, Sec. 24 (BC)
Washington County, Oregon

October 2023

TURF FARM
SEDIMENT BAG PLACEMENT
ALTERNATIVE



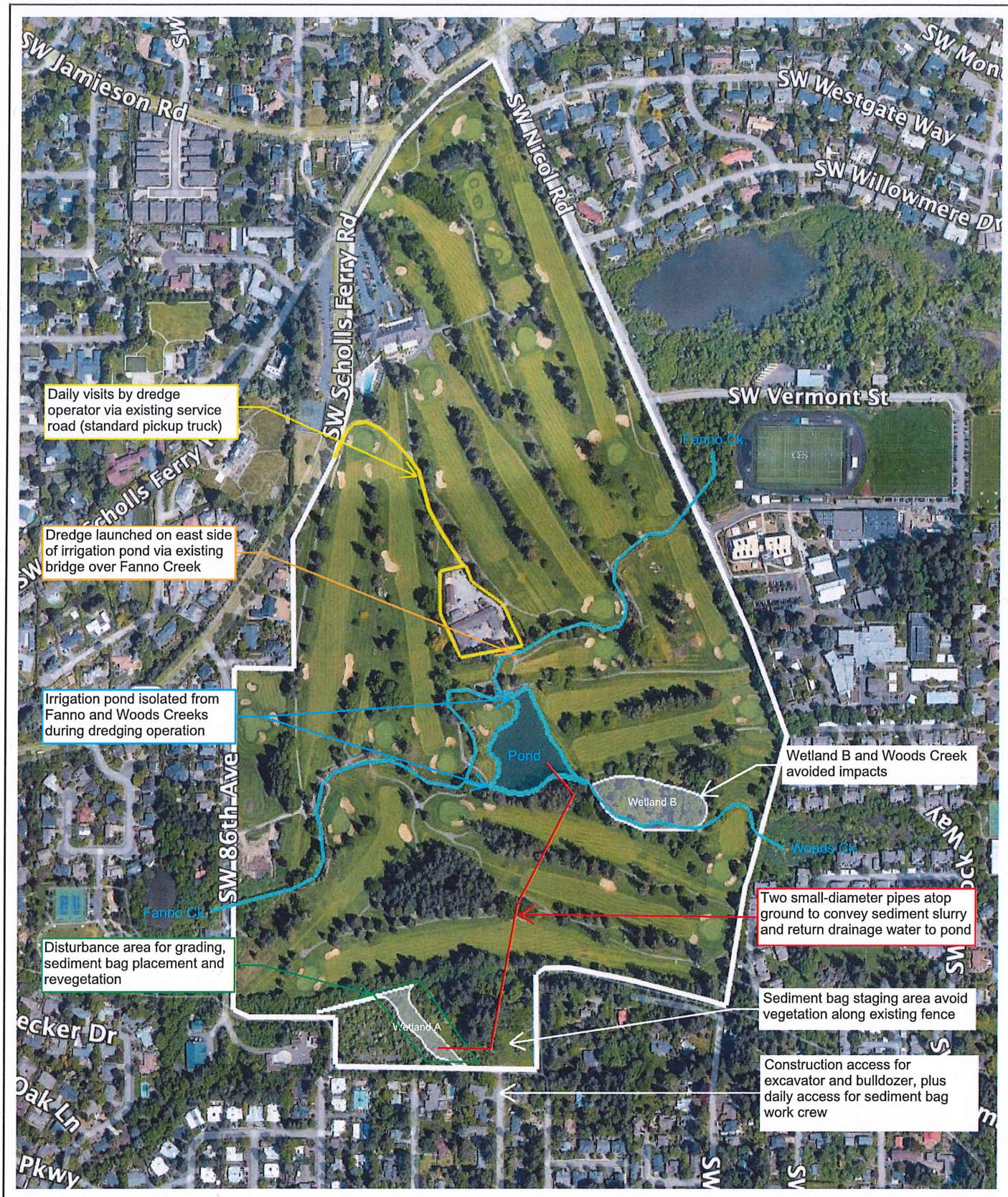
Terra Science, Inc.
Soil, Water & Wetland Consultants

GRAPHIC SCALE
0 ft. 400 ft. 800 ft.

ALTERNATIVES ANALYSIS FOR PORTLAND GOLF CLUB
IRRIGATION POND SEDIMENT REMOVAL AND PLACEMENT
Portion of TAX LOT 1700, T. 1S, R. 1W, Sec. 24 (BC)
Washington County, Oregon

October 2023

DRIVING RANGE, FAIRWAY AND OTHER REJECTED LOCATIONS FOR SEDIMENT BAG PLACEMENT



Terra Science, Inc.
Soil, Water & Wetland Consultants

GRAPHIC SCALE
0 ft. 400 ft. 800 ft.

ALTERNATIVES ANALYSIS FOR PORTLAND GOLF CLUB
IRRIGATION POND SEDIMENT REMOVAL AND PLACEMENT
Portion of TAX LOT 1700, T. 1S, R. 1W, Sec. 24 (BC)
Washington County, Oregon

June 2023

LEAST ENVIRONMENTALLY DAMAGING PRACTICABLE ALTERNATIVE (LEDPA) SEDIMENT BAG PLACEMENT)

October 16, 2023

Lonnie Lister
Portland Golf Club
5900 SW Scholls Ferry Road
Portland, OR 97225

Dear Lonnie,

I understand that Portland Golf Club is planning a project to remove sediment from Junor Lake on the golf course property. As part of that project, you are considering alternatives for disposal of the removed sediment, as well as potential options for the lake itself. You inquired regarding the following matters:

- The importance of maintaining Junor Lake as a water feature on the property; and
- The impact of storing large volumes (5,300 cubic yards) of silt sediment on the property:
    - Temporarily on top of a fairway for later disposal,
    - Under a fairway or multiple fairways for permanent disposal,
    - Permanently between fairways, or
    - Permanently in the yard debris area, turf farm area, or driving range area.

I have worked with Portland Golf Club as its golf course architect for the past 11 years, as well as working on the property prior to that time, so I am intimately familiar with the golf course property. I was a PGA Professional prior to transitioning to golf course architecture 23 years ago, and, since that transition, I have designed, improved, and worked on numerous golf courses. My experience is further outlined in the attached CV.

Successful golf course design includes numerous interrelated components that function together to provide the elements essential for golf play. Playability is an important component of golf course design, related to the ability of a course to accommodate all types and levels of play, allowing novice and professional golfers, and all in between, to enjoy a golf course. The width of a playing corridor is directly related to playability, allowing golfers to have options when playing a course. The narrower a course, the less options exist, and options are essential to strategy. Good design allows a less experienced player to take more shots to avoid challenging aspects of the course, while an experienced player will be able to make precise shots through the difficult elements of the design. Moreover, the sequencing of golf play requires variability between holes, and highlighting of the best natural features of the property and topography.

This is not to say that golf course design ends with its fairways and greens. Driving ranges and other practice areas are needed for players to improve their golf games. Transitions between holes are similarly part of the design and aesthetic of the course. Hazards should be beautiful and strategic and include variety, including bunkers, water hazards, rough areas, trees, and contours. Golf course must be constructed properly to incorporate all the necessary design elements, while also ensuring that soil and drainage are both appropriate to support the golf course landscaping. Finally, golf courses are supported by other basic components that are essential to upkeep and operations, such as areas for yard debris and growing replacement turf grass – a golf course

without these operational components cannot sustain the vast amount of work that goes into a golf course and its maintenance.

Junor Lake is an essential and central feature of the golf course's design. It is a water hazard, provides natural variety to the course, and serves as the golf course's source of irrigation water. It is extremely important for Portland Golf Club to maintain Junor Lake as part of the golf course's design and to restore and preserve the original depth of the lake to store necessary irrigation water.

Suitable locations for disposal of 5,300 cubic yards of silt do not exist on the golf course portion of Portland Golf Club's property. Portland Golf Club is located on a relatively small property for a modern golf course. Every portion of the golf course is interconnected and functions together to create a playable design. Taking a fairway out of play destroys playability because a 17-hole golf course is not a complete golf course. The areas between fairways are not unused space. To the contrary, the existing slopes and contours of the entire property are part of the design, as well as rough areas, hazards, and trees. Silt material is harmful to golf course drainage. Portland Golf Club employs numerous methods to improve drainage by increasing sand in its soils, and introducing 5,300 cubic yards of silt on the property would be disastrous for proper maintenance of the grounds. Finally, operations on the golf course would be substantially hindered if the yard debris area or turf production area are used for sediment disposal. The Portland Golf Club property would be damaged and less suitable for golf play if large amounts of silt is stored or disposed of within the golf course portion of the property or its necessary accessory areas.

In summary, maintaining Junor Lake is essential to the design of Portland Golf Club's course, and introducing 5,300 cubic yards of silt material within the golf course will damage the golf course design and maintenance. Please let me know if you have any further questions related to the sediment-removal project.

Sincerely,

Dan Hixson

DAN HIXSON
PRINCIPAL
HIXSON GOLF DESIGN
13707 Fielding Road
Lake Oswego OR 97034
503-789-7176
danlhix@yahoo.com

Hixson Golf Design was founded in 2000 by PGA Professional Dan Hixson. A life time of growing up within a golf Professional family provided the thorough understanding of the game and its courses. Initially providing master planning and renovation designs for clubs and courses, new course design was added to the portfolio with the opening of Bandon Crossings in 2008.

The company's philosophy is to combine an economical business sense to architecture with sound and artistically designed golf courses that excite and inspire golfers. Smart creative designs result in courses that people want to play over and over.

CORE KNOWLEDGE & FUNCTIONAL SKILL AREAS:

- Strategic team-oriented approach.
- Provides experience and resources to monitor the project from inception through grow-in.
- 23 years of in-field experience working with builders to carry out intent of plans and vision.
- Experienced in Construction Management and shaping of golf features.
- A thorough knowledge of the game of golf, its history, current trends, players and design strategy.
- Experienced in creation of both Master plans and new course routings of any sizes.
- Financial responsibility to clients through creative problem solving.

PROFESSIONAL HISTORY & CREDENTIALS

- Clackamas Community College 1979-81
- Oregon State University 1982-84
- PGA of America Member since 1990
- Head Golf Professional at Columbia Edgewater Country Club 1990-99
- OGCSA Member since 2010

PORTFOLIO – NEW COURSES

- **6 New Courses,** Bandon Crossings, Wine Valley, Crestview, Silvies Valley Ranch (2), Bar Run and Lake Oswego Municipal Golf Course.
- **Architect of Record -** Creating and implementing Long Range Golf Course Improvement Plans and Master Plans at 21 Golf Courses and Country Clubs in Washington and Oregon.
- **Total Courses Worked on,** to date is 48, with multiple and ongoing projects at many of the courses.
- **Four Original Designs** are continually highly ranked and or have won awards on a National level.
- **Currently working** on a dozen projects of various sizes.

October 14, 2023

Mr. Lonnie Lister
General Manager
Portland Golf Club
5900 SW Scholls Ferry Road
Portland, OR 97225

Dear Lonnie,

The purpose of this opinion letter is to address your question concerning the removal of sediment naturally accumulated in one of the lakes on your golf course.

As part of the permitting for that project, I understand that duly authorized government agencies with which you are working have questioned whether the silt dredged from the lake can be incorporated as soil on the golf course. Alternatively, the agencies have also inquired about converting accessory work areas (yard debris area and/or turf farm) to a disposal area for the 5,300 cubic yards of silt you plan to dredge from the lake.

As you know, I am currently a consultant with GGA Partners, a leading advisory services firm which specializes in golf-related matters and, specifically, in the areas of golf course asset development and financing. I was previously the Vice President – Golf for Pulte Homes, which now does business as Pulte Group, the largest developer of golf communities in the US. In that position, I developed 27 golf courses in 10 states, and was responsible for the operation of more than 20 Pulte golf courses. Based on this and other experience, let me answer your questions about best practices when managing golf courses, and the financial implications of certain management decisions.

Silt is a difficult material for golf courses to incorporate, generally speaking. Golf courses require excellent water drainage to support landscaping and surfaces that are suitable for golf play. Silt inhibits drainage because it fills the spaces between the bits of silt between other types of soil. Golf courses typically engage in activities that improve drainage, so I would not advise you to add silt to Portland Golf Club's mixture of soils. Disposing of the silt on the golf course may seem to be a desirable option due to availability and lower expense, but doing so may cause damage to the soil composition and negatively impact turf quality.

The quality of golf course landscaping is of critical importance to the playability of the course itself, and thus the long-term economic health of the business. Golf courses with poor drainage and consequently poor landscaping and playing surfaces offer inferior golf experiences for their golfers. Such golf courses cannot attract or maintain club members. Additionally, event sponsors only select golf courses for tournaments if they exhibit superior design, construction, and maintenance.

Without the ability to attract and retain members and to hold tournaments, a golf course cannot be profitable, and therefore cannot be sustained economically. It is unwise to use silt in the manner being considered as material harm can arise from such an approach.

GGA Partners
2415 East Camelback Road, Suite 700
Phoenix, Arizona 85016

Tel: 1-888-432-9494
Email: info@ggapartners.com
Web: ggapartners.com

Finally, work areas are essential features of all successful golf courses. Those playing the game of golf experience only the golf course itself and other guest areas. However, the work areas are what allow golf course managers to maintain the course and grounds. Golf courses create extensive amounts of yard debris every year and require substantial equipment to complete regular maintenance and repairs. Further, golf course turf requires frequent patching due to wear and infrastructure repairs. If it can be avoided, I would not advise you to convert the yard debris area or turf farm for sediment disposal. Doing so will decrease the function and value of the golf course property and require use of other areas or offsite areas to support the work that goes into managing the golf course.

I stand ready to provide additional insight, if needed. Please advise me if you have any other questions or if I can be of assistance.

Sincerely,

Henry DeLozier

GGA Partners USA LLC

ELLEN F. ROSENBLUM
Attorney General

FREDERICK M. BOSS
Deputy Attorney General

DEPARTMENT OF JUSTICE
GENERAL COUNSEL DIVISION

DATE: August 31, 2018

TO: Racquel Rancier, Senior Policy Coordinator
Oregon Water Resources Department

FROM: Renée Moulun, Assistant Attorney in Charge
Natural Resources Section

SUBJECT: Transferring primary reservoir rights

QUESTIONS PRESENTED AND SHORT ANSWERS

First Question Presented: Do Oregon Revised Statutes (ORS 540.510 and 540.520) allow for transfers of the primary storage right[1] to change the purpose or character for which water is stored?

Second Question Presented: Do ORS 540.510 and 540.520 allow for transfers of the primary storage right that would change the location of the reservoir, or all or a portion of the location of stored water?

Third Question Presented: Do ORS 540.510 and ORS 540.520 allow for transfers of the primary storage right that change the point of diversion? Is the answer different if the point of diversion is a pipe/ditch (reservoir is off channel) or the point of diversion is the dam (on channel)?

Fourth Question Presented: Does ORS 540.523 allow for temporary transfers of the primary storage right that change the location of the reservoir, or all or a portion of the location of stored water?

Short Answer: Under current statutes, no to all questions, because a primary storage right is not a "water use subject to transfer." Primary storage rights are rights to store water rather than rights to make use of the water stored, and the definition of "water use subject to transfer" refers only to water rights for a beneficial use of water. We suggest that if current water policies require the transfer of stored water, then legislation should be pursued.

[1] A primary storage right refers to a primary water right issued pursuant to ORS 537.400(1). A primary storage right is sometimes also referred to as a primary reservoir right. For the purposes of this memo our reference to primary storage rights is synonymous with primary reservoir rights.

ANALYSIS

It is well settled law in Oregon that "[b]eneficial use shall be the basis, the measure and the limit of all rights to the use of water in this state."[2] Once water is put to use, and the right perfected, it becomes appurtenant to the land and travels with the land, unless the seller specifically withholds those rights on sale.[3] However, any person seeking to sever the water from the land may, without losing the priority date, change the place of use, the type of use, or the point of diversion, consistent with the statutory provisions governing transfers.

Any person who holds a "water use subject to transfer" may make an application to the Water Resources Department for a permanent or temporary transfer.[4] Answering all of the questions presented requires interpreting the term "water use subject to transfer" to discern whether the legislature intended a "water use subject to transfer" to include a primary storage right.[5] Determining the intent of the legislature, in turn, requires an examination of the text and context of the statutes as well as consideration of pertinent legislative history.[6]

A. A water use subject to transfer must be a water right for a beneficial use of water

We begin our analysis with the text of ORS 540.510(1), and ORS 540.523(1) which both state that the holder of "a water use subject to transfer" may seek a transfer from the Water Resources Department. For the purposes of both statutes, ORS 540.505(4) defines "water use subject to transfer":[7]

> (4) "Water use subject to transfer" means a water use established by:
>
> (a) An adjudication under ORS chapter 539 as evidenced by a court decree;
>
> (b) A water right certificate;
>
> (c) A water use permit for which a request for issuance of a water right certificate under ORS 537.250 has been received and approved by the Water Resources Commission under ORS 537.250; or
>
> (d) A transfer application for which an order approving the change has been issued under ORS 540.530 and for which proper proof of completion of the change has been filed with the Water Resources Commission.

---

[2] ORS 540.610; Beneficial use without waste is a tenet that is foundational in Oregon water law. *Bennett v. City of Salem*, 192 Or 531, 544 (1951)(In the context of water law in Oregon, "water use" means "beneficial use without waste" meaning that "what water an appropriator appropriates must be devoted to a beneficial use, and he is never entitled to divert more water than is actually put to such use, reasonable transmission losses excepted").

[3] ORS 540.510(1*)*; *Klamath Irrigation Dist. v. U.S*., 348 Or 15, 26 – 27 (2010); *Teel Irrigation Dist. v. Water Resources Department*, 135 Or App 16, 18 (1995), *affirmed in part and vacated in part* 323 Or 663 (1996); *Wilber v. Wheeler*, 273, Or 855, 862 (1975)(Water rights are appurtenant to land, and not to ownership of land); *Cookinham v. Lewis*, 58 Or 484, 491 (1911)(Beneficial use of water acquired under a permit must contemplate use on specific land which when completed shall become appurtenant to the land to which it is applied).

[4] ORS 540.510(1); ORS 540.523(1).

[5] *PGE v. BOLI*, 317 Or 606, 610-12 (1993).

[6] ORS 174.020; *State v. Gaines*, 346 Or 160, 171 -72 (2009).

[7] The definitions in ORS 540.505 apply to both permanent and temporary transfers. ORS 540.505(1).

The text of the definition states that a "[w]ater use subject to transfer means a *water use*" established by any of the following types of water rights listed in subsections 4(a) – (d).[8] As the Oregon Supreme Court clarified in *Ft. Vannoy Irrigation District v. Water Resources Commission*, the term "water use subject to transfer" refers to the water right itself, "not merely [to] the use of water provided under the [right].[9] That is, "water use subject to transfer" refers not just to the use element of a water right, but to all of the terms of the appropriation as represented in the water right such as the quantity of water appropriated, time period or season of use, point of diversion, the type of use, the place of use, the priority date, and the identity of the holder who is authorized to change the elements of the right.[10] In other words, the water right itself (including the terms of appropriation) is subject to transfer.

Not every water right is a "water use subject to transfer" however. The text specifies that a water use subject to transfer "means a water use" that is "established by" one of the four types of water rights listed, meaning, that only water rights for a "water use" may be transferred. To read the statute as allowing the transfer of any water right (whether it is for a water use or not) would be to impermissibly omit the phrase "water use" as it qualifies the word "established by [the four types of water rights]" from the definition of "water use subject to transfer."[11] The question then becomes what the legislature intended by the term "water use" as a water use may be established by one of the four types of water rights listed in ORS 540.505(4)(a)-(d).

The term "water use" in the context of Oregon water law, means "beneficial use without waste."[12] Other provisions of ORS Chapter 540 which are the context of ORS 540.510, confirm that the legislature intended to allow the transfer process only for water rights for a beneficial use. For example, ORS 540.520(1), which governs the transfer application process, clarifies the types of water uses that may be transferred, and allows for the transfer of other water "uses" not specified in the text.

> Except when the application is made under ORS 541.327 or when an application for a temporary transfer is made under ORS 540.523, *if the holder of a water use*

---

[8] Emphasis added. The water uses in ORS 540.505(4)(a)-(d) are water rights that are sufficiently vested or choate to allow transfer of the right. The word "established" means to "settle or fix after consideration or by enactment or agreement." *PGE v. BOLI*, 317 Or at 611 ("Words of common usage typically should be given their plain, natural, and ordinary meaning."); *Webster's Third New International Dictionary* (3rd edition).

[9] Because "water use subject to transfer" may be considered a "term of art" judicial construction of the term is considered context. *State v. Dickerson* 356 Or 822, 829 (2015)(referring to terms of art used in the legal profession); *Ft. Vannoy Irrigation Dist. v. Water Resources Commission*, 345 Or 56, 78 (2008)(interpreting "water use subject to transfer").

[10] *Id., citing Tudor v. Jaca et al*., 178 Or 126, 152- 43 (1945).

[11] ORS 174.010(Office of the judge is to ascertain and declare what is contained in the statute and not to insert what has been omitted, or to omit what has been inserted.); *PGE v. BOLI*, 317 Or at 611(In ascertaining the meaning of a statute, the court considers the rules of construction of statutory construction including the "statutory enjoinder 'not to insert what has been omitted, or to omit what has been inserted.'").

[12] ORS 537.120(water may be appropriated for a beneficial use and not otherwise); ORS 540.610 provides in relevant part that "[b]eneficial use shall be the basis, the measure and the limit of all rights to the use of water in this state." Beneficial use without waste is a tenet that is foundational in Oregon water law. *Bennett v. City of Salem*, 192 Or at 544.

> *subject to transfer for irrigation, domestic use, manufacturing purposes, or other use,* for any reason desires to change the place of use, the point of diversion, or the use made of the water, an application to make such change, as the case may be, shall be filed with the Water Resources Department.

(Emphasis added.)

In addition, the contents of a transfer application focus on previous water use and only authorize transfer of a water right that is not subject to forfeiture (i.e., loss of the water right because of non-use) and for which there is evidence of use under the right within the past five years:

> (2) The application required under subsection (1) of this section shall include:
> (a) The name of the owner;
> (b) The previous use of the water;
> (c) A description of the premises upon which the water is used;
> (d) A description of the premises upon which it is proposed to use the water;
> (e) The use that is proposed to be made of the water;
> (f) The reasons for making the proposed change; and
> (g) Evidence that the water has been used over the past five years according to the terms and conditions of the owner's water right certificate or that the water right is not subject to forfeiture under ORS 540.610. [13]

Other provisions of ORS 540.510 address transfers of water rights for a beneficial use of water. For example, ORS 540.510(1) directs that supplemental water rights must be transferred along with primary water rights in order to assure that a transfer will not result in enlargement.[14] Other subsections of ORS 540.510 allow for changes in the point of diversion,[15] address the use of conserved water on lands,[16] provide an exception to the rule of appurtenance to municipalities, ports, and water supply districts,[17] authorize any district water right "to be applied to beneficial

---

[13] ORS 540.520(2).

[14] ORS 540.505(2) and (3) define "primary" and "supplemental water rights" and ORS 540.510(1) provides the regulatory mechanisms that prevent transfers from resulting in enlargement of rights that could occur if one exercised primary and supplemental rights simultaneously on separate parcels of land. "Enlargement" means:

> "an expansion of a water right and includes, but is not limited to:
> (a) Using a greater rate or duty of water per acre than currently allowed under a right;
> (b) Increasing the acreage irrigated under a right;
> (c) Failing to keep the original place of use from receiving water from the same source; or
> (d) Diverting more water at the new point of diversion or appropriation than is legally available to that right at the original point of diversion or appropriation."

OAR 690-380-0100(2).

[15] ORS 540.510(5)(allowing relocation of a point of diversion without going through the transfer process to follow the movements of a naturally changing stream); ORS 540.510(6)(authorizing a change in the point of diversion in the event government action results in or creates a reasonable expectation of a change in the surface level of a surface water source that impairs an existing point of diversion).

[16] ORS 540.510(2)(stating that the use of conserved water may be severed from the land and transferred and sold); ORS 540.510(7)(clarifying that the lease of the right to the use of conserved water does not constitute a change of use or a change in the place of use).

[17] ORS 540.510(3)(allowing "any water used" under a permit or certificate issued to a municipality to "be applied to beneficial use on lands to which the right is not appurtenant" according to certain conditions).

use on lands within the district to which the right is not appurtenant,"[18] and allow the application of exempt groundwater to land for irrigation purposes without going through the transfer process.[19] In sum, ORS 540.510 governs water rights for a beneficial use and affords flexibility that allows the continued beneficial use of water under changing circumstances. None of the provisions in ORS 540.510 address water rights for the storage of water or the transfer of stored water, though the legislature has clearly articulated such intent in other statutes governing transfers.

> Provided that the proposed transfer complies with all of the provisions of this subsection and will not result in injury to any existing water right, a district with a manager may, for one irrigation season, temporarily transfer the place of use of water appurtenant to any land within the legal boundaries of the district to an equal acreage elsewhere within the legal boundaries of that district *or temporarily transfer the type of use identified in a right to store water*. * * *[20]

In conclusion, the text and context of ORS 540.505(4) illustrate that the legislature intended that a "water use subject to transfer" must be a water right for a beneficial use of water. Because the definition of "water use subject to transfer" provided in ORS 540.505(4) applies to the statutes governing permanent and temporary transfers, we may conclude that only holders of water rights for a beneficial use of water may either permanently or temporarily transfer their water rights.

B. A primary storage right is not a "water use subject to transfer"

Having resolved what types of water rights are subject to transfer, our analysis now focuses on whether a primary storage right issued pursuant to ORS 537.400 is a "water use subject to transfer." Our conclusion is that it is not, because, generally, storage of water is not in and of itself a beneficial use of water, and a primary storage right is not a water right established by a "water use".

Except for certain ponds and "alternate reservoirs", appropriations of water for storage in a reservoir are governed by ORS 537.400.[21] Primary storage rights and secondary use rights are issued pursuant to ORS 537.400(1) which reads as follows:

> All applications for reservoir permits shall be subject to the provisions of ORS 537.130, 537.140, 537.142 and 537.145 to 537.240, *except that an enumeration of any lands proposed to be irrigated under the Water Rights Act shall not be required in the primary permit*. But the party *proposing to apply to a beneficial*

---

18 ORS 540.510(4).

19 ORS 540.510(8).

20 ORS 540.570(1)(governing temporary transfers within districts).

21 ORS 537.405 addresses "exempt reservoirs." ORS 537.405 governs reservoirs existing before January 1, 1993. ORS 537.409 governs "alternate reservoirs". ORS 537.248 allows municipalities or districts 10 years to complete construction of diversion or storage works and to perfect the water right and specifies that applications for reservoir permits are subject to the provisions of ORS 537.140 to 537.211. This advice, therefore, is pertinent to reservoirs authorized by ORS 537.248.

> *use the water stored in any such reservoir* shall file an application for permit, to be known as the secondary permit, in compliance with the provisions of ORS 537.130, 537.140, 537.142 and 537.145 to 537.240. The application *shall refer to the reservoir for a supply of water* and shall show by documentary evidence that an agreement has been entered into with the owners of the reservoir for a sufficient interest in the reservoir *to impound enough water for the purposes set forth in the application*, that the applicant has provided notice of the application to the operator of the reservoir and, if applicable, that an agreement has been entered into with the entity delivering the stored water. *When beneficial use has been completed and perfected under the secondary permit*, the Water Resources Department shall take the proof of the water user under the permit. The final certificate of appropriation shall refer to both the ditch described in the secondary permit and the reservoir described in the primary permit.

(Emphasis added.)

The first sentence of the statute states that all applications for "reservoir" permits shall be subject to the same provisions governing the application for any other permit, except that an enumeration of any lands proposed to be irrigated shall not be required in the primary permit. ORS 537.130, which is referenced in the first sentence of ORS 537.400(1), provides that a "person may not use, *store* or divert any waters until after the department issues a permit to appropriate the waters" (emphasis added). That is, the word "use" is distinguished from the word "store", demonstrating that the legislature intended that a permit may be obtained for the storage of water, as apart from a permit to use water.[22] ORS 537.140, which is also referenced in the first sentence of ORS 537.400(1), specifies that an application for a permit to construct a reservoir "shall give the height of the dam, the capacity of the reservoir, *and the uses to be made of the impounded waters*" (emphasis added).[23] In sum, the text of ORS 537.400(1) authorizes the appropriation of water for storage under a primary permit, and the statutes referenced in the first sentence, in turn, distinguish the right to store water from the right to use water, and require that applications for reservoir rights include the use to be made of the waters impounded.

The second sentence of ORS 537.400(1) distinguishes storage of water from the use of the water stored by stating "*[b]ut the party proposing to apply to a beneficial use the water stored*" in the reservoir must file an application for a permit "to be known as the secondary permit" (emphasis added).[24] The application for the secondary permit "shall refer to the reservoir for a supply of water" and shall show "by documentary evidence" that the applicant has entered into an agreement with the owner of the reservoir "for a sufficient interest in the reservoir to impound enough water for the purposes set forth in the [secondary] application." In other words, an applicant seeking to apply to beneficial use the water that is stored must identify

---

[22] ORS 537.120(2); *Dept. of Transportation v. Stallcup*, 341 Or 93, 101 (2006)(Use of different words suggests that each was intended to have a different meaning).

[23] ORS 537.140(1)(d).

[24] Letter of Advice to Senator Timms from Donald C. Arnold, Chief Counsel (OP-6423)(September 14, 1992)(stating that the Bureau of Reclamation may not release stored water for beneficial purposes other than the purposes specified in its water right certificate and clarifying that if the bureau seeks to use water stored for a different purpose that it must obtain a new water right).

the reservoir that is the source of supply and show that they have a sufficient interest in the reservoir to impound the amount of water that will be used under the secondary permit. In short, the primary storage right is the source of the water to be put to beneficial use under the secondary permit.

"When beneficial use has been completed and perfected under the secondary permit," the department must take the proof of the "water user" under the secondary permit. The final certificate of appropriation, then, must refer to both the appropriation described in the secondary permit (the taking of water from the reservoir for use) and the reservoir described in the primary permit (the source of the water used). With the exception of in-reservoir use of water for stock watering, all uses of stored water must be pursuant to a secondary right.[25]

The context of ORS 537.400 confirms that a primary water right is a storage right rather than a water right that is established by water use.[26] For example, ORS 537.147 provides an expedited process for obtaining a secondary permit "*to use stored water*" from an existing reservoir and specifies that an applicant for an expedited permit must submit "evidence that the proposed use of the stored water is one of the authorized uses under the water right permit, certificate, or decree that allows the storage of water."

ORS 537.409 governs the "alternate permit application process" for reservoirs that have a storage capacity of less than 9.2 acre feet or a dam or impoundment structure less than 10 feet high. Under the "alternate" process the owner of the reservoir submits an application for a permit to appropriate and store water. However, "any person applying for a secondary permit for the use of stored water" from the reservoir must use a certified water right examiner to make the final proof survey which "shall apply to the storage reservoir and to the secondary use of the water in the reservoir."[27]

ORS 537.346 refers specifically to conversion of minimum perennial streamflows that *use* stored water.[28] In addition, ORS 537.385 authorizes the extension of an irrigation season where the supply of water is storage and sufficient storage exists to support the use under an extended season. In other words, storage is a source of water that is apart from natural flows, which source may supply water for subsequent beneficial uses.

Finally, it is worth noting that where the legislature intended the storage of water in a reservoir to in and of itself constitute a beneficial use of water, it has stated as such in the statutory text.

---

[25] ORS 537.400(2) states that where the beneficial use of water is the retention of water in the pond for watering livestock, a secondary permit is not required, though a water right is required to maintain water in the pond.

[26] Other statutes addressing the storage and use of stored water are context for ORS 537.400. *See State v. Klein*, 352 Or 302, 309 (2012)(a statute's context includes related statutes).

[27] It is not entirely clear whether the legislature intended also to make the storage of water in an alternate reservoir a beneficial use as indicated by reference to filing a "claim for beneficial use" in aid of certificating a storage right. It is clear, however, that the water in an alternate reservoir is a source and supply for use of water *outside* of the reservoir.

[28] ORS 537.346(2).

> Reservoirs in existence on or before January 1, 1995, that store less than 9.2 acre-feet of water or with a dam or impoundment structure less than 10 feet in height, *are found to be a beneficial use of the water resources of this state*.[29]

In conclusion, the text and context of ORS 537.400(1) make clear that a primary storage right is the supply of water for the secondary water right which makes use of the water impounded.[30] A water right authorizing appropriation of storage, therefore, is not a water right that is established by water use, and so is not a "water use subject to transfer".

CONCLUSION

Both ORS 540.510 and ORS 540.523 allow the holder of a "water use subject to transfer" to either permanently or temporarily transfer their rights. A "'[w]ater use subject to transfer' means a *water use* established" by one of the four types of water rights listed in ORS 540.505(4)(a)-(d). Because the right subject to transfer must be established by a "water use," a "water use subject to transfer" means a water right for a beneficial use of water. A primary storage right allows appropriation and impoundment of water for a subsequent use and is not in and of itself a water right that is established by a "water use." Because a primary storage right is not a water right for beneficial use of water, it is not a "water use subject to transfer."

We understand that the current practices of the Water Resources Department do not conform to this advice, and in light of this, suggest the department seek legislation that facilitates current water management policies and needs.

---

[29] ORS 537.405(1)(emphasis added).

[30] This advice concerning the character of a right to store water is consistent with previous advice. *See e.g.* 25 Op Atty Gen 206 (1951)("Storage in and of itself is not a use." Storage must be for a future purpose); *see also* 38 Op Atty Gen 956 (1977)(Describing the primary permit as applying to storage of water in a reservoir and the secondary permit as applying to the beneficial use such water).

Raleigh
Water
District

October 13, 2023

Lonnie Lister
Portland Golf Club
5900 SW Scholls Ferry Road
Portland, OR 97225

Dear Lonnie,

As you know, Portland Golf Club ("PGC") is within the boundaries of the Raleigh Water District (the "District"), which is a domestic water supply district formed under ORS, chapter 264, in the Portland metropolitan area. You inquired about whether the District might be able to supply large volumes of water to PGC on a temporary or permanent basis for its irrigation needs.

In order to supply water to PGC for irrigation, there are a couple hurdles that will need to be figured out. First, the District purchases water from the City of Portland under contract. PGC's large water demand will increase the District's peak water use in the summer, which will increase rates throughout the District and therefore may be expensive for PGC and all District customers. Second, the District receives water through a water line shared with other utilities. In the summer months, the District often reaches capacity for its share of use from the water line. As such, water deliveries to PGC may be restricted to available capacity, PGC may need to restrict its usage to particular times, or infrastructure upgrades may be required. Third, summer interruptible water is an option that is available from the City of Portland. This option would require the District to apply to the City of Portland for a specific amount of water to be purchased during a specified time frame above the contracted amount. This water is billed at a specified rate and is payable to Portland whether it is used or not. This amount would be passed on to PGC. However, the summer interruptible water is not guaranteed and is totally at the discretion of the City of Portland.

The District is willing to further discuss options for water deliveries to PGC. Please note that the District's standard terms for water delivery include the ability to curtail water use when supplies are insufficient for all users, and domestic needs may be prioritized over irrigation. The District is not able to offer guaranteed irrigation water service in large volumes to PGC throughout the year.

Sincerely,

Matt Steidler
District Manager
Raleigh Water District