
ALTERNATIVES EVALUATION AND SELECTION

This chapter provides a detailed description of the alternatives screening performed under Phase 2 Steps 2.2 and 2.3 (as described in Section 5.3). The screening process is described in detail in memoranda titled “CSO Control Alternative Review and Comment Procedure” (Carollo Engineers, September 2009) and “Alternative Narrowing Process” (Tetra Tech, November 2009).

7.1 OVERVIEW

Each of the preliminary alternatives in the Barton and Murray Basins was evaluated for technical merit, ability to be implemented (impacts on the community, environmental impact, etc.), and cost. Between August and November 2009, the number of alternatives was reduced from nine for each basin to a shortlist of three for each basin. After public meetings in March and April 2010, the County established a community advisory group to address concerns raised by the public regarding the shortlisted Murray CSO basin alternatives. Meetings throughout the summer and fall of 2010 resulted in nine new alternatives that were developed and evaluated. The alternatives refinement process was occurring during this time. During the alternatives refinement process, the project team modified Barton Alternative 4A to use green stormwater infrastructure (GSI) for disconnecting impervious area from the combined sewer system rather installing storm drains.

The County engaged in a final evaluation process to assess the key technical, environmental and permitting issues, public impacts, and costs. Two alternatives for Barton and two for Murray were forwarded to management with a summary of key considerations resulting from the technical evaluation. King County management made the final decision on which CSO reduction projects would move forward for further environmental review.

7.2 PRELIMINARY SHORT-LIST DEVELOPMENT

The preliminary alternatives for the Barton and Murray CSO basins, refined as described in Section 6.6, were reviewed King County and project-team staff in a series of workshops in December 2009. The workshop summary and documentation is in Appendix B.

7.2.1 Barton CSO Basin Preliminary Short-List

Based on the workshop results, the following short list of Barton CSO basin alternatives was recommended for further refinement and evaluation:

- **Barton Alternative 1E—Pipe Storage, Upper Fauntleroy Way SW:**
 - A buried, 12-foot-diameter off-line storage pipe approximately 150 feet long with 0.22 MG of storage volume, in Upper Fauntleroy Way from the intersection of SW Director Street to north of the intersection with SW Henderson Street.
 - Gravity flow into the storage facility and pumped flow out.
 - Above-grade odor control and electrical facilities.

- A diversion structure at the intersection of Fautleroy Way and Director Street to control peak flow rates downstream to the Barton Pump Station and direct excess flows to the storage pipe.
- **Barton Alternative 1F—Rectangular Storage in the Vicinity of Fautleroy School:**
 - A buried, rectangular concrete storage tank with 0.22 MG of storage volume, near the Fautleroy School parking lot.
 - Gravity flow into the storage facility and pumped flow out.
 - Above-grade odor control and electrical facilities.
 - A diversion structure in Director Street to control peak flow rates downstream to the Barton Pump Station and direct excess flows to the storage pipe.
- **Barton Alternative 4A—Peak Flow Reduction, Sub-Basin 416:**
 - New storm sewers throughout Barton Sub-basin 416 to disconnect street runoff from the combined sewer system (no disconnection of rooftops and other private property storm flows from the combined system).
 - Stormwater treatment to meet stormwater regulations and permitting requirements.
 - During the alternatives refinement process, this alternative was developed in to a GSI alternative.

7.2.2 Murray CSO Basin Preliminary Short-List

Based on the workshop results, the following short list of Murray CSO basin alternatives was recommended for further refinement and evaluation:

- **Murray Alternative 1A—Rectangular Storage, Bottom of the Basin:**
 - A buried, rectangular concrete storage tank with 1.0 MG of storage volume, adjacent to the existing Murray Pump Station in Lowman Beach Park.
 - Gravity flow into the storage facility and pumped flow out.
 - Above-grade odor control and electrical facilities.
 - Modification of the existing CSO control structure to add a diversion control structure with weirs and gravity piping to storage.
- **Alternative 1C—Distributed Storage in Beach Drive & Murray Avenue:**
 - Two 12-foot diameter off-line storage pipes with a total storage volume of 1.0 MG, in Murray Avenue SW from the intersection with Lincoln Park Way (approximately 350 feet long) and in Beach Drive extending northward from Lowman Beach Park (approximately 900 foot long).
 - Gravity flow into the storage facilities and pumped flow out.
 - Above-grade odor control and electrical facilities.

- One diversion structure on Murray Avenue SW upstream of the intersection with Lincoln Park Way and one on Beach Drive adjacent to the pump station.
- During the alternatives refinement process, it was determined that the storage pipes cannot be installed using open trench methods because required excavation depths would be greater than 30 feet. Tunneling or other trenchless methods would be required, making this alternative infeasible. Therefore, Murray Alternative 1C was removed from further consideration.
- **Alternative 1F—Combined Pipe and Tank Storage, Bottom of the Basin:**
 - A buried, rectangular concrete storage tank on private properties near the Murray Pump Station and a 12-foot diameter buried off-line storage pipe in Beach Drive.
 - A storage volume of 1.0 MG would be distributed between the two facilities. If 1.0 MG of storage cannot be provided on the private properties, the difference would be made up with the storage pipe in Beach Drive.
 - The tank would have a minimum volume of 0.6 MG and the pipe would have a maximum volume of 0.4 MG.
 - Gravity flow into the storage facilities and pumped flow out.
 - Above-grade odor control and electrical facilities.
 - Modification of the existing CSO control structure to add a diversion control structure with weirs and gravity piping to storage.

7.3 MURRAY BASIN COMMUNITY ADVISORY GROUP ALTERNATIVES

7.3.1 Community Advisory Group Process

After the preliminary alternatives were short-listed to three alternatives per basin, the County held public meetings to inform the public of the short-listed alternatives and to receive comments and feedback. The Barton CSO basin public meeting was conducted on March 18, 2010 and the Murray CSO basin public meeting was conducted on March 29, 2010. The County also presented the short-listed alternatives at a regular meeting of the Morgan Junction Community Association on April 21, 2010.

The County received comments and feedback from the Murray and Morgan Junction Community strongly indicating that the short-listed alternatives were not acceptable. The community's key concerns involved the following:

- Impacts on Lowman Beach Park
- Impacts on private property
- Concerns that the Murray community was bearing an undue burden because storage facilities were sized to handle flows coming to the Murray Pump Station from the Barton Pump Station.

In response to the concerns and opposition from the community, King County agreed to form a community advisory group (CAG) to help develop alternatives that would meet the County's CSO control needs, address the community's desire to reduce impacts at the bottom of the Murray basin, and provide a solution that meets the needs of both the Barton and Murray basins. A report summarizing the chartering and development of the CAG is in Appendix C. Part of the alternative development process involved providing education and background on CSO control in these two basins. A review of the project team's development of preliminary alternatives and the initial screening was provided.

The CAG met from June through September 2010. The meeting schedule and topics discussed are shown in Table 7.1. The schedule for evaluating the Barton alternatives was paused during the Murray CAG process because the two basins are hydraulically linked, so CSO control decisions for the two basins needed to be considered together.

7.3.2 Community Advisory Group Alternatives

The CAG initially brainstormed approaches to controlling CSOs in the Murray basin. This brainstorming effort identified nine initial CAG alternatives. These initial CAG alternatives used peak flow storage, peak flow conveyance, impervious area disconnection and a combination of these methods to control CSOs. Some included improvements in the Barton basin as part of the recommendation to control CSOs in the Murray basin.

The project team developed technical details to better define the initial CAG alternatives and identify key technical requirements. An initial evaluation was conducted and some alternatives were removed from further consideration because they were not technically feasible or they were similar to project-team alternatives that had been removed from consideration during preliminary screening (such as conveyance of peak flows to Alki). The CAG reviewed the nine project-team alternatives to determine which should be included with the CAG-developed alternatives for the CAG's evaluation. The CAG selected a modified version of Murray Alternative 1B (renamed Murray 1B-b) and Murray Alternative 1F.

These efforts resulted in a group of five CAG alternatives and two project-team alternatives that were evaluated by the CAG in September 2010 (see Appendix C for figures of all alternatives evaluated by the CAG):

- **CAG 2—Storage in Lincoln Park Near Colman Pool:**
 - A buried, rectangular concrete storage tank with 1.25 MG of storage, next to the Colman Pool in Lincoln Park.
 - A flow diversion vault with motorized control valves and telemetry.
 - Peak flows pumped to the 1.25 MG tank from the Barton Pump Station and pumped out of the tank to the Barton Pump Station force main.
 - Below-grade odor control and electrical facilities.
 - 0.1 MG of storage at the bottom of the Murray Basin.
 - Flow diverted to the 0.1-MG storage facility from a gravity diversion structure and pumped out.

Table 7.1 Murray Community Advisory Group Meetings

Focus	Topics
<u>CAG Meeting 1, June 9, 2010</u>	
Introduction and Objectives	Introduction of the CAG members. Overview of the goals and objectives. Discussion of work plan and list of items to discuss.
<u>Technical Session, June 19, 2010</u>	
Technical Session	Review of the previous work on the CSO project by the County and project team. Review of the preliminary alternatives and their development. Some suggestions regarding community-generated alternatives were developed.
<u>CAG Meeting 2, June 24, 2010</u>	
Washington State CSO Regulations	The CAG was introduced to the state's CSO regulations and requirements. The Department of Ecology representative discussed permit requirements and associated fines
<u>CAG Meeting 3, July 13, 2010</u>	
City of Seattle CSO Program/ Modeling and Sizing of CSO facilities	Developed an understanding of the City's CSO program and how the County and City coordinate CSO planning efforts. King County's modeling group described collection system modeling and how it is used to determine storage and conveyance requirements to control CSOs.
<u>CAG Meeting 4, August 3, 2010</u>	
City of Seattle Park Department Policies & Green Stormwater Infrastructure	Seattle Parks discussed policies regarding non-park uses and an explanation of Initiative 42 and City of Seattle Ordinance 118477, which restricts non-park uses within City Parks. King County and the project team discussed the use of green stormwater infrastructure as a CSO control measure. It was discussed how this alternative may be used to control CSOs in the Barton basin, but would not be a feasible alternative to control CSOs in the Murray basin.
<u>CAG Meeting 5, August 19, 2010</u>	
Guiding Principles and Alternatives Development	The project team provided a technical presentation of the initial CAG-developed alternatives. The CAG developed guiding principles for further development and evaluation of alternatives.
<u>CAG Meeting 6, August 30, 2010</u>	
Presentation of Guiding Principles and Level of Achievability Analysis for Alternatives	CAG members deliberated and agreed on a set of guiding principles. The project team presented a level-of-achievability analysis for the CAG-developed alternatives. Planning level comparative cost estimates for the CAG-developed alternatives were presented.
<u>Workshop, September 9, 2010</u>	
Alternative Optimization and Definition	This workshop involved technical discussions to optimize final alternatives for a final evaluation. Some alternatives initially proposed were deemed technically infeasible and were removed from consideration. The list of CAG-developed alternatives and project-team alternatives was set for evaluation in the next CAG meeting.

Table 7.1 Murray Community Advisory Group Meetings	
Focus	Topics
<u>CAG Meeting 7, September 15, 2010</u>	
Alternatives Presentation and Screening	This meeting involved presentation of the CAG alternatives and selected project-team alternatives for evaluation by CAG. The CAG initiated the screening process by applying the guiding principles to each alternative and determining which alternatives needed to be eliminated from consideration.
<u>CAG Meeting 7.5, September 27, 2010</u>	
Final Screening of Alternatives (Additional Meeting)	CAG members screened the list of 16 alternatives down to five. The CAG received comments and input from the public to be used in a final report of findings and recommendations to be submitted to King County.
<u>CAG Meeting 8</u>	
Final Recommendation	The CAG prioritized the five remaining alternatives and developed recommendations for the County to consider in its final evaluation for a CSO control project in the Murray and Barton basins.

- **CAG 2-a—Storage in Lincoln Park Lower Parking Lot:**
 - Same as CAG 2 except that the buried, rectangular 1.25-MG concrete storage tank would be located in the Lincoln Park Lower Parking lot.
- **CAG 2-b—Storage Tunnel in Lincoln Park:**
 - Same as CAG 2 except that Barton basin storage would be provided by a large-diameter storage tunnel in Lincoln Park between Colman Pool and the lower parking lot, with storage up to 2 MG, depending on diameter.
- **CAG 8—Upper Basin Storage for Murray Peak Flows:**
 - Distributed storage, with up to four tanks at various up-basin sites to control tributary peak flows and a bottom-of-basin storage facility to reliably control overflows.
 - Exact storage volumes to be confirmed through extensive modeling; it was estimated that 0.5 MG would be required at the bottom of the basin and 1 MG of total storage volume would be required up-basin.
 - Telemetry and control to actively divert flows to storage when peak flow events and potential overflows are predicted.
 - Stored volumes pumped out of each facility to the local sewer after the peak event has past.
- **CAG 9—Combined Storage, Pumping & Disconnection Improvements:**
 - Increased storage volume for the Barton basin (to 0.5 MG from 0.22 MG)
 - Barton Pump Station peak flow capacity limited to 26 mgd

- 0.86 MG of storage in the vicinity of Lincoln Park Way and Murray Avenue
- A 10-mgd peak flow pump station adjacent to the existing Murray Pump Station to lift peak flow volumes from the bottom of the basin to storage.
- On-site disconnection throughout the Murray basin to reduce storage requirements.
- **Murray Alternative 1B-b—Storage in the Vicinity of Lincoln Park Way and Murray Avenue SW:**
 - A 0.6-MG rectangular storage tank on the vacant lot at the northwest corner of the intersection of Lincoln Park Way and Murray Avenue SW
 - A 0.4-MG 12-foot-diameter storage pipe in Murray Avenue SW.
 - Two diversion structures to send peak flows to the storage pipe and storage tank
 - A 10-mgd peak flow pump station adjacent the existing Murray Pump Station to lift peak flow volumes from Barton to storage.
- **Murray Alternative 1F—Combined Pipe and Rectangular Storage at the Bottom of the Basin**
 - This is the same alternative as described in Section 7.2.2.

7.3.3 Community Advisory Group Recommendations

Through evaluation and deliberation, the CAG removed Alternatives CAG 2-b and CAG 9 from consideration. Alternative CAG 2-b was removed because of the high costs and impacts of tunneling in the park. Alternative CAG 9 was removed because of high cost, low reliability, and difficulty in effectively implementing on-site roof disconnection.

The CAG recommended Alternative CAG 2-a in its October 2010 report to King County. The group identified Murray Alternative 1B-b as a “fallback” alternative if the County determined that Alternative CAG 2-a was not feasible. The group did not eliminate any of the other alternatives from consideration, but advanced them to the County for the project team’s consideration during a final selection process.

7.3.4 Coarse Screening of Murray Basin Alternatives

In December 2009, the project team conducted an evaluation and coarse screening of the five alternatives forwarded by the CAG (CAG 2, CAG 2-a, CAG 8, Murray 1B-b, and Murray 1F) and one remaining preliminary alternative short-listed by the project team (Murray Alternative 1A) The coarse screening assessed whether any alternatives should be removed from consideration because of significant technical challenges or costs. Table 7.2 summarizes the key evaluation points and considerations of the coarse screening evaluation.

**BARTON AND MURRAY COMBINED SEWER OVERFLOW CONTROL FACILITIES PLAN
ALTERNATIVES EVALUATION AND SELECTION**

Table 7.2. Murray Basin CSO Coarse Screening Matrix

What are the significant challenges associated with this alternative?					Why should alternative move forward?
Community Impact	Technical	Environmental	O&M	Land Use/ Permitting	
CAG 2 – Storage in Lincoln Park Near Colman Pool					
<ol style="list-style-type: none"> 1. Long-term impact associated with siting a CSO facility in a high-use park setting. 2. Not accepted by the Barton community. Very likely will appeal all permits. 3. Impacts on ferry traffic and Fauntleroy traffic during construction. 4. Concurrent construction impacts on the Fauntleroy community for 5-7 years from multiple construction projects (Barton PS upgrade; CAG 2; and Barton CSO project). 5. Surface features will affect existing park users. 6. Construction right next to pool will increase safety concerns and other impacts of nearby park users. 7. ADA access restrictions for community to pool 8. Is an Olmsted park designation. 	<ol style="list-style-type: none"> 1. Very difficult to construct due to limited site space and distant access from streets for construction crews and equipment. 2. Requires complex control scheme for flow diversion. Reliable flow control is uncertain because King County does not have experience or familiarity with this type of flow control. 3. Results in two storage structures for Murray Basin. Reduces the storage size at Murray, but does not eliminate the need for storage and all associated site impacts. 4. County still has to build a facility for odor control and generator by Lowman Park. 5. Limits on construction period; may be closed to construction during summer months for pool. 6. Lots of manpower/flagging needs during construction. 7. Geotech issues – close to ground water/saline water. 8. Not maximizing capacity of conveyance. 	<ol style="list-style-type: none"> 1. Possible tree removal. 2. Restoration area/ volunteer grants for restoration. 3. Historic status of pool. 	<ol style="list-style-type: none"> 1. Serious concerns over complexity of routing flows out of Barton PS force mains and facility located between two pump stations. 2. County has no previous experience with motorized valves and predictive ability to use these valves. 3. Access to tank – pedestrian hazards on path. 	<ol style="list-style-type: none"> 1. The park is in CR zoning. The proposed use is prohibited and will require code amendment or rezoning. 2. Would have to demonstrate no other feasible alternative. 	Not recommended for further evaluation.
CAG 2-a – Storage at Lincoln Park Lower Parking Lot					
<ol style="list-style-type: none"> 1. Impacts on ferry traffic and Fauntleroy traffic during construction. 2. Concurrent construction impacts on the Fauntleroy community for 5-7 years from multiple construction projects (Barton PS upgrade; CAG 2; and Barton CSO project). 3. Odor concerns in parking lot; trapped air/pressure to gravity. 4. Parking disruption for O&M activities 5. ADA access 6. May need additional odor control by Lowman Park. 7. Parking reduction and traffic detours will impact large organized events, in addition to typical park users, at this regional park. 	<ol style="list-style-type: none"> 1. Requires complex control scheme for flow diversion. Reliable flow control is uncertain because King County does not have experience or familiarity with this type of flow control. 2. Results in two storage structures for Murray Basin. Reduces the storage size at Murray, but does not eliminate the need for storage and all associated site impacts. 3. County still has to build a facility for odor control and generator by Lowman Park. 4. Not maximizing use of conveyance. 5. Adjacent arterial access facilitates construction. 6. Better location for constructing deep excavation from geo tech perspective. 	<ol style="list-style-type: none"> 1. Possible impact on trees. 2. Vegetated areas around park disrupted. 	<ol style="list-style-type: none"> 1. Not first choice due to complexity factor (but solvable). 2. Risk of reliability needs quantifying. 3. Safety for access in parking lot 	<ol style="list-style-type: none"> 1. Lengthy, uncertain process associated with allowing use of existing park property for CSO facility. However, siting majority of facilities within existing parking area may mitigate this issue. 2. Differentiator being under parking lot as opposed to traditional park use. 3. Can restore park use to close to what was originally there. 4. Staging in park. 	The impacts on the community are well documented. Limiting facilities to within existing parking areas may reduce the impact on parks, making this alternative more feasible from a land use perspective.

**BARTON AND MURRAY COMBINED SEWER OVERFLOW CONTROL FACILITIES PLAN
ALTERNATIVES EVALUATION AND SELECTION**

Table 7.2. Murray Basin CSO Coarse Screening Matrix

What are the significant challenges associated with this alternative?					Why should alternative move forward?
Community Impact	Technical	Environmental	O&M	Land Use/ Permitting	
CAG 8 – Upper Basin Storage					
<ul style="list-style-type: none"> 1. Long-term impact associated with siting numerous CSO facilities throughout the neighborhood. The proposed sites require siting in two parks. 2. New stakeholders that will need to be engaged. 3. High traffic impacts in multiple locations. 	<ul style="list-style-type: none"> 1. Multiple diversion and storage points throughout the upper portion of collection increases system complexity, thereby decreasing the certainty of reliable flow control. 2. Upper basin storage requires larger storage facilities than bottom-of-basin storage in order to increase the certainty of flow control. 3. Does not eliminate the need for bottom-of-basin storage. 4. Construction – concurrent or sequential both present high challenges due to limited site space for construction and staging. 5. Greater uncertainty in predicting flows higher in basin. 6. As many storage tanks as rest of the entire program. 7. Storage higher in the basin increases the potential to surcharge the collection system and the possibility of local sewer backups. 	<ul style="list-style-type: none"> 1. Two parks involved. 2. Traffic, noise, disruption throughout community. 3. High potential for encountering soil contamination (dry cleaner) 	<ul style="list-style-type: none"> 1. Multiple facilities for O&M staff to maintain; increases staffing requirements and reduces overall system reliability. 	<ul style="list-style-type: none"> 1. Lengthy, uncertain process associated with property acquisition at multiple sites. This includes parks again. 2. Parks locations will require council approval. 	<p>Not recommended for further evaluation.</p>
Murray Alternative 1A –Storage at Lowman Beach Park					
<ul style="list-style-type: none"> 1. Long-term impact associated with siting a CSO facility in a high-use park setting. Lowman Beach Park zoned Conservancy Recreation with prohibited utility service use. 2. Surface features may affect park users. 3. Strong opposition from CAG/community. 4. Could threaten schedule due to resistance. 	<ul style="list-style-type: none"> 1. Best technical alternative, as well as for future odor/generator. Close to existing facility. 2. The scheme in Alternatives 1A and 1F is the simplest and most predictable to operate based on prior experience. Highest certainty of performing reliable flow control. 	<ul style="list-style-type: none"> 1. Loss of old trees. 2. Conservancy zone. 	<ul style="list-style-type: none"> 1. The park is in CR zoning. The proposed use is prohibited and will require code amendment or rezoning. 2. Would have to demonstrate no other feasible alternative. 	<p>The impacts on the community are well documented. However, this alternative is a very cost-effective, reliable alternative for CSO control.</p>	

**BARTON AND MURRAY COMBINED SEWER OVERFLOW CONTROL FACILITIES PLAN
ALTERNATIVES EVALUATION AND SELECTION**

Table 7.2. Murray Basin CSO Coarse Screening Matrix

What are the significant challenges associated with this alternative?					Why should alternative move forward?
Community Impact	Technical	Environmental	O&M	Land Use/ Permitting	
Murray Alternative 1B-b –Storage in Vicinity of Murray Ave. & Lincoln Park Way					
1. CAG #2 choice (after CAG 2A) 2. Requires another large pump station in the park area. 3. May require property acquisition. 4. Construction in street as well as in the triangle; extensive impacts on the community.	1. The site at Murray Ave and Lincoln Ave is difficult to access and build on. 2. Peak flow PS needed (10 mgd) near existing Murray PS. 3. Two storage facilities needed; increases construction. 4. Opportunity to avoid building diversion structure and connect to existing PS, although a larger peak flow pump station would be needed.	1. The site contains wetlands and an associated stream. The feasibility of obtaining environmental approvals for this alternative is highly uncertain. 2. Lengthy council review (minimum 12 months).	1. Complex operations. 2. Reliability concerns. 3. Multiple facilities required for stable control.	1. Lengthy, uncertain process associated with allowing use of existing park property for new pump station if sited in park. 2. Private property acquisition potentially required for new pump station. 3. Storage tank permitting/ approval requires City Council approved revisions to the Critical Areas Ordinance.	Not recommended for further evaluation.
Murray Alternative 1F – Storage on Private Property in the Beach Drive Area					
1. Community expressed long-term impact associated with changing the character of the neighborhood residential area. 2. Work will extend into ROW. 3. Cannot rebuild homes. 4. Property acquisition required (15 units, ~ 30 people).	1. Nearby steeply sloped areas present technical and geotechnical challenges during design and construction. 2. The scheme in Alternatives 1A and 1F are the simplest and most predictable to operate based on prior experience. Highest certainty of performing reliable flow control.			1. Requires acquisition of up to six privately owned properties. 2. Facility extends into ROW.	Although there are technical challenges, the planning team is confident that these can be reasonably dealt with during design. This alternative is a cost-effective, reliable alternative for CSO control.

Based on the coarse screening, the project team recommended removing the following alternatives from consideration:

- Alternative CAG 2** – This alternative was removed from consideration due to its location in Lincoln Park and its proximity to the shoreline. This alternative would have long-term impacts on a high-use park setting and would be difficult to construct due to limited site space and distant access to streets. It would require a complex control scheme for diversion of peak flows and would not be as reliable as other alternatives located at the bottom of the basin. Access to the tank for maintenance purposes would be difficult, because pedestrian traffic is high at the proposed location.

- **Alternative CAG 8**—This alternative was removed from consideration due to concerns about reliability and because of the cost associated with siting four separate facilities throughout the basin in addition to a facility at the bottom of the basin. This alternative would require complicated telemetry and predictive control algorithms to divert flows in the upper basin to storage. The challenge associated with accurately and reliably predicting when to divert flows to storage results in the need for a storage facility at the bottom of the basin. Because this alternative is less reliable and more costly, and does not result in the elimination of a storage facility at the bottom of basin; it was removed from consideration.
- **Murray Alternative 1B-b**—This alternative was removed from consideration because the proposed location of the rectangular storage facility is on an undeveloped parcel that has an unpermitted section of Pelly Creek running through it. City of Seattle Real Estate Services confirmed that there are wetlands on this property. Field investigation confirmed that these wetlands are associated with the creek. The creek, wetland, and wetland buffer take up a majority of the developable land on this parcel. Seattle Development Code prohibits development on buffers of wetlands associated with a creek or stream. The alternative also requires a large peak-flow pump station at the bottom of the basin that would need to be sited in the vicinity of the existing Murray Pump Station.

7.3.5 Murray Basin—Final Short List

Based on the CAG evaluation and the project team’s subsequent coarse screening, the final short-listed alternatives for the Murray Basin are as follows:

- Alternative 1A— Rectangular Storage at Bottom of Basin in Lowman Beach Park.
- Alternative 1F—Rectangular and Pipe Storage on Private Property at Bottom of Basin.
- CAG Alternative 2-a—Storage in Lincoln Park Lower Parking Lot.

7.4 FINAL SHORT-LISTED ALTERNATIVES—BARTON BASIN

7.4.1 Refinement of Barton Alternatives

Between January 2010 and October 2010, the three short-listed alternatives for Barton were further developed by the project team. This included the development of control flows and volumes for mid-basin storage alternatives, as described in Section 4.2.1. This work occurred concurrently with the CAG process, although final evaluation of the Barton alternatives was not conducted until the CAG process was complete. Table 7.3 summarizes pertinent data for the final short-listed Barton alternatives. Details are provided in the following sections.

Table 7.3 Barton Basin Short-Listed Alternatives Data			
	Alternative 1E	Alternative 1F	Alternative 4A (GSI)
Type of Facility	Buried, Off-Line Storage Pipe	Buried, Rectangular Tank	Roadside Rain Gardens
Facility Dimensions	12' diameter, 265' length	38' x 68' area, 15' deep	N/A
# Internal Channels	1	2	N/A
Sewer	48" diameter	48" diameter, 80' length; open-cut w/drop structure for diversion	N/A
Excavation Limits to Shoring	300' x 16' area, 30' deep	80' x 60' area, 30' deep	~10' – 15' wide; swale depth ~6" – 10"
Diversion Control Structure Dims:	15' x 15' area, 15' deep	20' x 20' area, 15' deep	N/A
Odor Control/Electrical Footprint	60' x 20' area, 13' to 15' high	50' x 20' area, 13' to 15' high	N/A
Land acquisition	In right-of-way	6,000 square feet (tank)	In right-of-way
Construction Limits, Staging	40' x 350' on site (14,000 square feet); contractor to find off site staging	20,000 square feet potentially available	Within planter strips between existing curbs and sidewalks, along 32-65 half-blocks in Sub-basin 416
Street Use	See Property Acquisition Plan	See Property Acquisition Plan	See Property Acquisition Plan

7.4.2 Barton Alternative 1E—Pipe Storage in Upper Fautleroy Way

This alternative (see Figure 7.1) features a diversion structure and a 12-foot-diameter, 265-foot-long concrete storage pipe with a capacity of 0.22 MG, inlet and drain structures at the pipe ends, a flushing gate for cleaning, and submersible pumps for draining. The storage pipe would be located in Upper Fautleroy Way SW between the intersections of SW Director Street and SW Henderson Street. It would be constructed by cut-and-cover methods. Excavation up to 30 feet deep would require shoring. This section of street right of way would be impassable during construction, but temporary access for adjacent properties and detour routes for traffic would be provided.

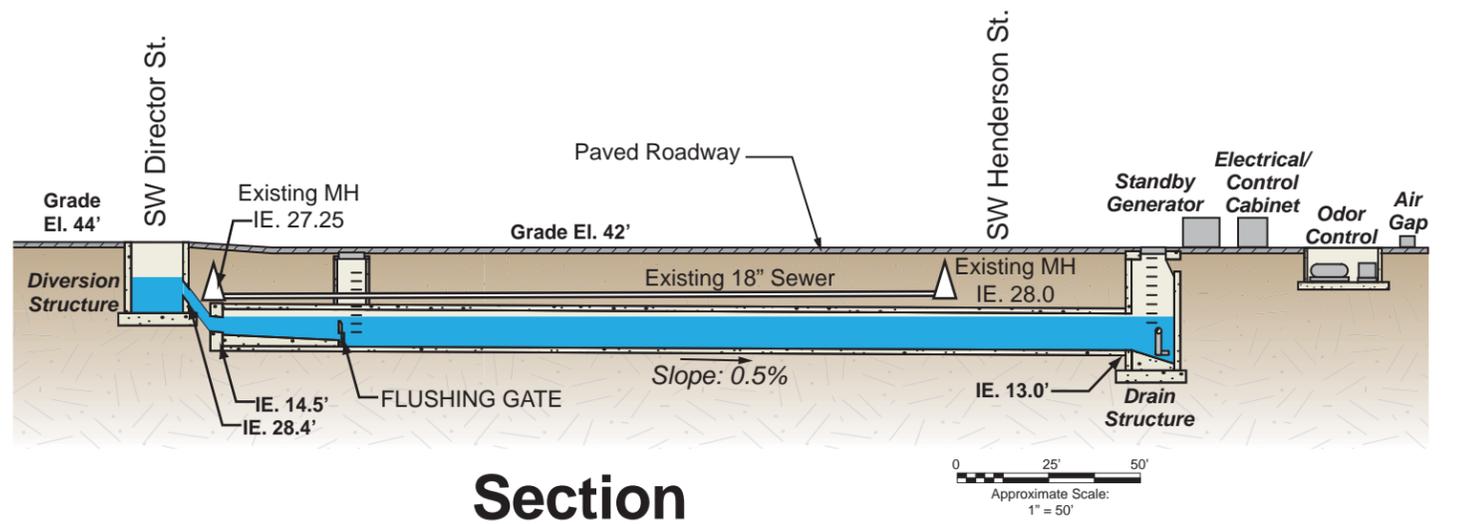
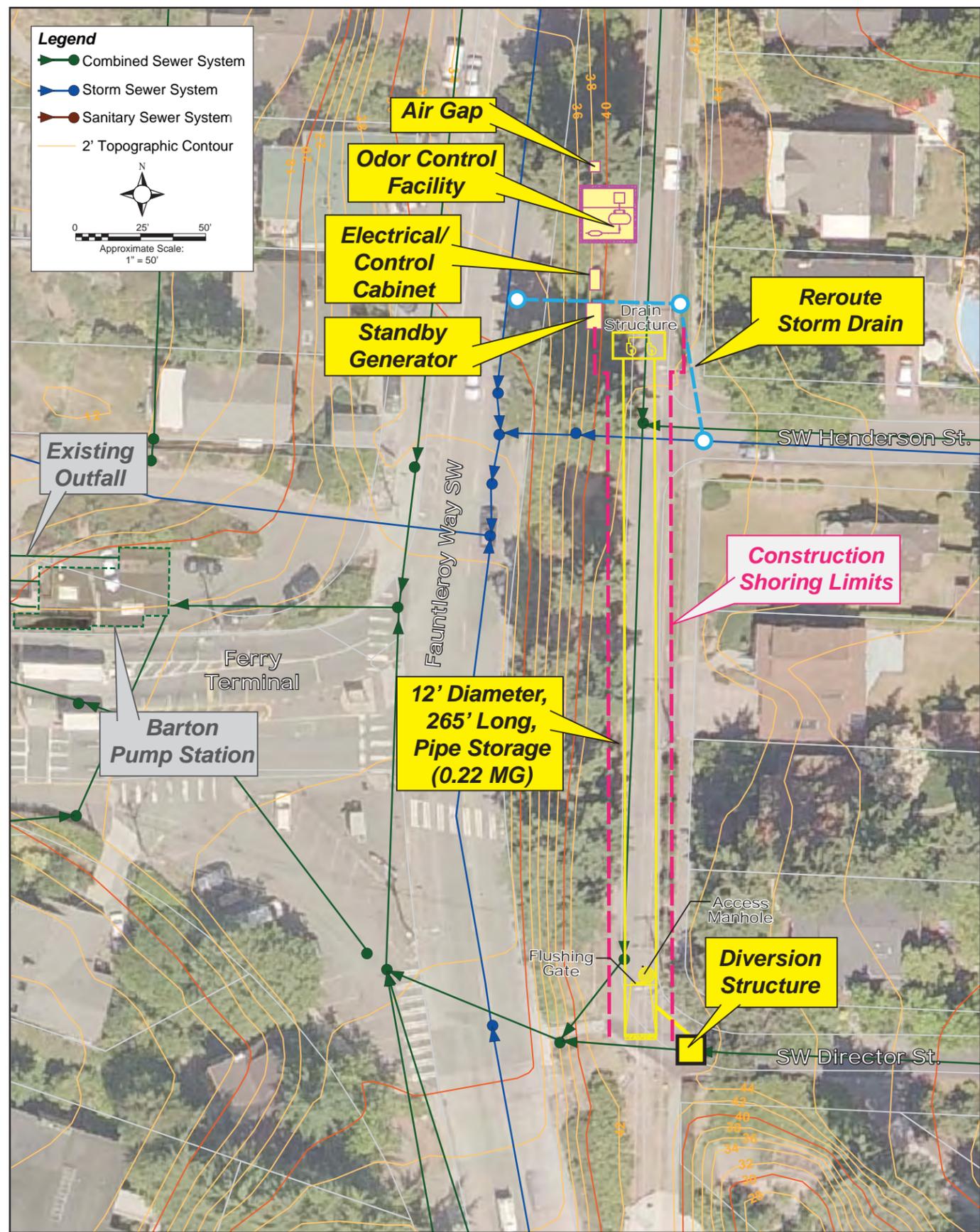


Figure 7.1.
FINAL BARTON ALTERNATIVE 1E: PIPE STORAGE IN UPPER FAUNTLEROY

The new diversion structure would replace an existing manhole along the SW Director Street sewer. It would have a restrictive flow apparatus such as an orifice or a gate that would limit downstream flow to approximately 11 mgd to provide control at the bottom of the basin. Excess flows above 11 mgd would be diverted through a 48- inch sewer to the storage facility, which would retain the required volume until rainfall has ceased for a pre-set time. At that time, submersible drain pumps would pump the stored contents back to the local sewer in SW Henderson Street over a 12-hour period.

The storage facility would be equipped with carbon scrubber odor control, electrical equipment, and a backup generator, housed in a separate above-grade structure within the right of way, set back from the traveled roadway. The storage facility would be accessed from the top, within the roadway. Access ways would be located at the ends of the pipe for maintenance. Cleaning equipment would be flushing gates.

This alternative was evaluated using the criteria shown in Appendix B. The following sections describe evaluation considerations.

7.4.2.1 Land Use and Permitting

The site for Alternative 1E is within a street right-of-way in a residentially zoned area, and adjacent to a community open space. The project would require local permit only.

7.4.2.2 Property Acquisition

The alternative identifies ancillary facilities as being located within the right-of-way outside of the paved roadway. Depending upon final design requirements, ancillary facilities may need to be located on easements from one or two private parcels.

7.4.2.3 Environmental

There are no historic resources in the project area, but the area has a high probability of containing archaeological resources. Significant archaeological resources have been found adjacent to the project area in the past. Excavation for the pipeline will likely extend into native soils.

There are no wetlands, streams, or shorelines within the project area, but Fauntleroy Creek is approximately 100 feet to the south. Fauntleroy Creek is used by coho and cutthroat for spawning and rearing. Construction most likely would require removal of Douglas fir and Pacific madrona along the west edge of Upper Fauntleroy Way, which may meet the Seattle Municipal Code (SMC) definition of exceptional trees. There are no known contaminated sites near the proposed project location.

7.4.2.4 Technical

This is considered a mid-basin alternative and will require careful management of flows to ensure that bottom-of-basin flow quantities do not exceed the Barton Pump Station's capacity. This alternative requires a complex diversion structure to divert flows to storage using a restrictive flow device rather than a simple overflow weir at the bottom of the basin.

There may be opportunity to lengthen the storage pipe to the north in the future and expand capacity for flexible adaptability.

There may be construction difficulties with groundwater, archaeological conditions, and excavation. The existing right of way is narrow and there will be issues associated with construction sequencing and residential access during construction. There is limited area available for staging and material lay-down.

7.4.2.5 Operation and Maintenance

A large-diameter pipe storage facility is familiar to the county for operations. However, this alternative requires street access through hatches for maintenance. Traffic control procedures would be required, involving street use/closure permits for major maintenance activities. Routine access of electrical and odor control equipment may be within the right-of-way but outside the traveled roadway. There would be more limited access to this facility because of the street and topography.

7.4.2.6 Costs

This alternative is the least costly of the short-listed alternatives; at this level of estimating, its cost is essentially equal to that of Alternative 1F. See Appendix B for a summary of comparative costs.

7.4.2.7 Community

Construction at this site would have three substantial impacts on the community:

- Short-term impacts from approximately 650 truck trips for removal of excavated materials and import of construction materials. The haul route would include Fauntleroy Way, which has substantial ferry traffic, and an upgrade project for the Barton Pump Station immediately adjacent to this proposed site.
- Short-term impacts from reduction of parking and restriction of access to the six residences along Upper Fauntleroy Way.
- Intermittent traffic interruptions for the six property owners on Upper Fauntleroy Way due to major maintenance activities (approximately once every five years).

7.4.3 Barton Alternative 1F—Buried Rectangular Storage Tank, at Fauntleroy School

This alternative (see Figure 7.2) features a 20-by-20-foot diversion structure, 80 feet of 48-inch-diameter gravity sewer, and a 0.22-MG rectangular, buried, cast-in-place concrete storage tank with a tank cleaning mechanism and submersible pumps for tank draining. The tank would be located in the parking lot west of the Fauntleroy School.

The diversion structure would be located in SW Director Street. It would have a restrictive flow apparatus such as an orifice or a gate that would limit the downstream flow to

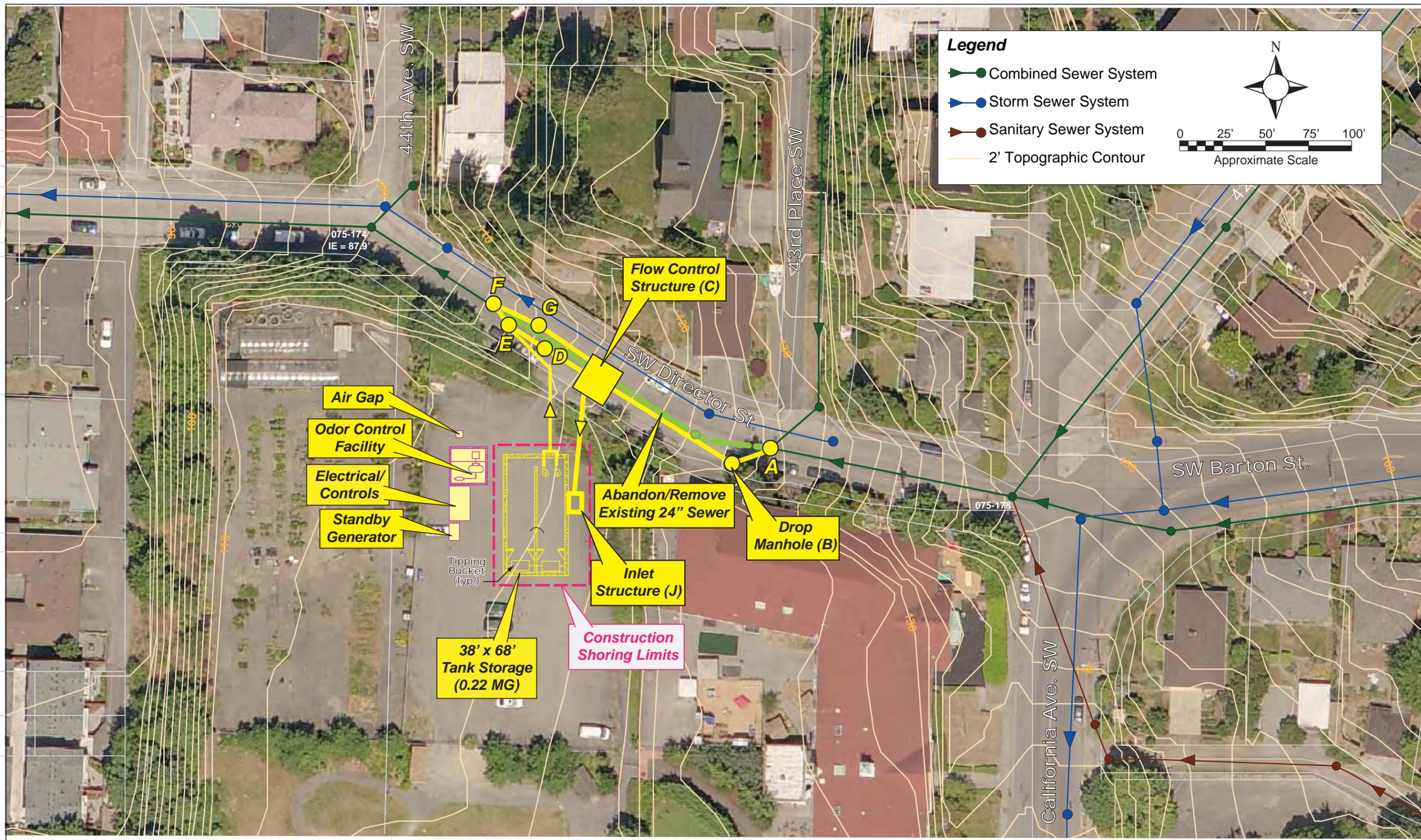


Figure 7.2.
FINAL BARTON ALTERNATIVE 1F: BURIED RECTANGULAR STORAGE TANK AT FAUNTLEROY SCHOOL

approximately 11 mgd to provide control at the bottom of the basin. Flows beyond 11 mgd would be diverted through the 48-inch sewer to the storage facility.

The storage facility would retain the required volume, depending on the total peak storm volume, until rainfall has ceased for a pre-set time. At that time, submersible drain pumps would pump the stored contents back into the local sewer in SW Director Street over a 12-hour period.

The tank would have an area of 38 feet by 68 feet and a water depth of 15 feet. It would be constructed by cut-and-cover methods. A shored excavation in level ground would be required. It is anticipated that the tank would be covered by 2 to 4 feet of earth and gravel or asphalt pavement. A 20-by-50-foot above-grade structure would house carbon scrubber odor control, electrical equipment, and a backup generator.

The tank would be accessed from the top at the ends for maintenance. Cleaning equipment would consist of flushing gates or tipping buckets, to be determined during detailed design.

This alternative was evaluated using the criteria shown in Appendix B. The following sections describe evaluation considerations.

7.4.3.1 Land Use and Permitting

Zoning of the project site is single-family residential. Existing use is a parking lot for the Fauntleroy Community Center. The diversion structure would be located in street right-of-way. Only local permits would be required. No federal or state permits would be required.

Because there would be local traffic impacts for construction of the diversion structure, temporary and emergency access provisions would be required. Above-grade structures would be below height limits prescribed in SMC (Seattle Municipal Code).

7.4.3.2 Property Acquisition

King County would need to acquire a permanent easement from the Fauntleroy Community Association for the tank, as well as a temporary construction easement. The area required for the easement is listed as the land acquisition requirement in Table 7.3.

The Seattle School District is renting out the parcel to the west, which is being used as a nursery area. Access is through the existing parking lot. A temporary construction easement from Seattle School District may be necessary for access during construction.

7.4.3.3 Environmental

There are no known archaeological resources in the project area, but based on site characteristics, the area has a medium probability of containing such resources. Fauntleroy School may be nominated as a Seattle Landmark. Excavation for the tank construction will likely extend into native soils.

No impacts are anticipated on fish or wildlife. Fauntleroy Creek is approximately 300 feet south of the south edge of the parking lot, which may have construction activity. Fauntleroy

Creek is used by coho and cutthroat for juvenile rearing. No impacts are anticipated on the creek or the creek buffer. There are no wetlands or shoreline within the proposed project area. There are no known contaminated sites within the project area.

7.4.3.4 Technical

This is considered a mid-basin alternative and will require careful management of flows to ensure that bottom-of-basin flow quantities do not exceed the Barton Pump Station's capacity. This alternative requires a complex diversion structure to divert flows to storage using a restrictive flow device rather than a simple overflow weir at the bottom of the basin. There is additional room on this site for expansion if flows are greater than currently predicted.

This alternative is relatively straightforward to construct and operate. The storage tank site is on flat ground with easy access from SW Director Street. However, construction of the drop structure and diversion structure would require deep excavation (30 to 35 feet deep) within the SW Director Street right of way.

7.4.3.5 Operation and Maintenance

This alternative would have the best access for tank, odor control and electrical facility maintenance of the short-listed storage alternatives. The tank site would be easily accessed from Director Street and there would be adequate space around the tank for maintenance. The tank is a familiar concept for the county. Access and maintenance of the drop structure and diversion structure in SW Director Street would require traffic control and flagging.

7.4.3.6 Costs

This alternative is the second least costly of the short-listed alternatives; at this level of estimating its cost is essentially equal to that of Alternative 1E. See Appendix B for a summary of comparative costs.

7.4.3.7 Community

Construction at this site has two substantial impacts on the community:

- Short-term impacts from approximately 600 truck trips for removal of excavated materials and import of construction materials. The haul route would be along SW Director Street, SW Barton Street and Delridge Way SW.
- 14 to 18 months of construction impacts on local residents and the businesses and tenants of the Fauntleroy Community Center; from traffic disruption to reduction of parking and restriction of access to the Fauntleroy Community Center.
- Intermittent traffic interruptions for local traffic on SW Director Street due to intermittent maintenance of the drop structure and diversion structure. There would be major maintenance activities (approximately once every five years) for the storage tank, which would restrict use of the parking lot during those times. Intermittent maintenance

of the odor control facility would require routine access through the parking lot, but should not result in significant loss of use.

7.4.4 Barton Alternative 4A (GSI)—Green Stormwater Infrastructure in Sub-Basin 416

During the alternative refinement process, the project team modified Alternative 4A to use GSI techniques for addressing impervious area runoff rather than using a conventional sewer separation approach involving installation of storm drains. GSI captures rainfall runoff in facilities that retain and/or infiltrate it into the ground. GSI was selected based on capital cost, community support, and ongoing operation and maintenance requirements. The capital cost to disconnect street drains and install storm drains throughout Sub-basin 416 would be considerable because construction would be complex and extensive. Current codes could require stormwater treatment, which would add to the capital costs and require ongoing operation and maintenance. The County received considerable positive feedback for GSI from the community during public meetings and outreach efforts. For these reasons, the project team developed technical refinements to scope Alternative 4A as a GSI alternative.

The refined alternative features bioretention/bioinfiltration facilities (roadside rain gardens) in Barton Sub-basin 416 within planting strips between the curb and sidewalk or within new curb bulbs at street ends (see Figure 7.3). Stormwater runoff from the street right-of-way would be diverted to the rain gardens to provide additional storage and allow a portion of the runoff water to infiltrate. Enough stormwater would be diverted and infiltrated or stored to achieve CSO control at the pump station. Rain gardens would be installed in 32 to 65 half blocks, to be determined by final modeling. The alternative would provide 2.0 MG of volume reduction and 14.6 mgd of peak flow reduction during the design storm event.

This alternative was evaluated using the criteria shown in Appendix B. The following sections describe evaluation considerations.

7.4.4.1 Land Use and Permitting

This alternative is not within the Shoreline zone and would not require a Shorelines permit. Right-of-way permits would be required. Affected roadways have moderate traffic volume in residential and neighborhood commercial land uses. Work hours may be restricted; construction would require careful traffic planning to maintain access as a condition of the required permits.

7.4.4.2 Property Acquisition

No property acquisition would be required; SDOT would likely consider this a street beautification project. Since there would be no pipes or structures within the street right-of-way street, use fees should be minimal.

7.4.4.3 Environmental

There are no known archaeological sites or cultural resources identified in the Sub-basin 416 area, and, based on area characteristics, the sites for rain gardens have a low probability of

containing such resources. This project involves limited excavation and minimal or no disturbance of native soils.

Construction of this alternative would not affect fish, wildlife, or their habitat. This alternative would create new habitat and would likely increase dry-weather flows to Longfellow Creek. There are no wetlands, streams or shorelines in the project area. There are no known contaminated sites in the project area. The project area is not within a liquefaction zone. There are no steep slopes or potential or known landslide areas.

7.4.4.4 Technical

This is the simplest of the Barton alternatives considered for operation. The rain gardens would be passive and would not require staff for startup. There would be regular and periodic maintenance of the rain gardens to ensure their ability to divert, infiltrate, and store stormwater. This would involve plant maintenance and soil maintenance in addition to maintenance levels of weeding and debris removal.

This alternative would require further modeling to determine the number of rain gardens and the number of affected streets in Sub-basin 416. Additionally, extensive geotechnical and hydrogeological studies would be conducted to fully understand effects on groundwater and the fate of diverted stormwater locally and within the area. This alternative is easily expandable should additional control be required.

There should be no significant construction related issues or risks beyond typical landscape construction in right-of-way. Construction would require temporary traffic control and the accommodation of temporary access.

7.4.4.5 Operation and Maintenance

The rain gardens would operate passively and would not require staff for startup. Periodic maintenance would be required to ensure effective operation during storm events. Maintenance would be low tech compared to a conventional wastewater facility and would be relative straightforward (garden maintenance and periodic soil/plant replacement). Maintenance would require working alongside a traveled roadway but would not require significant traffic control or workers in the traveled right-of-way.

7.4.4.6 Costs

Costs for this project would be highest of the evaluated alternatives. However, this alternative would not require property or easement acquisition, which can bring budgetary uncertainty to the other alternatives. See Appendix B for a summary of comparative costs.

7.4.4.7 Community

This alternative provides streetscape beautification, traffic calming along streets using curb bulbs, habitat enhancement and enhancement of neighborhood identity. It would require coordination with property owners during rain garden installation. Public outreach efforts would be required so that the County can partner with property owners regarding the rights and responsibilities associated with rain gardens (i.e., they will be County-maintained

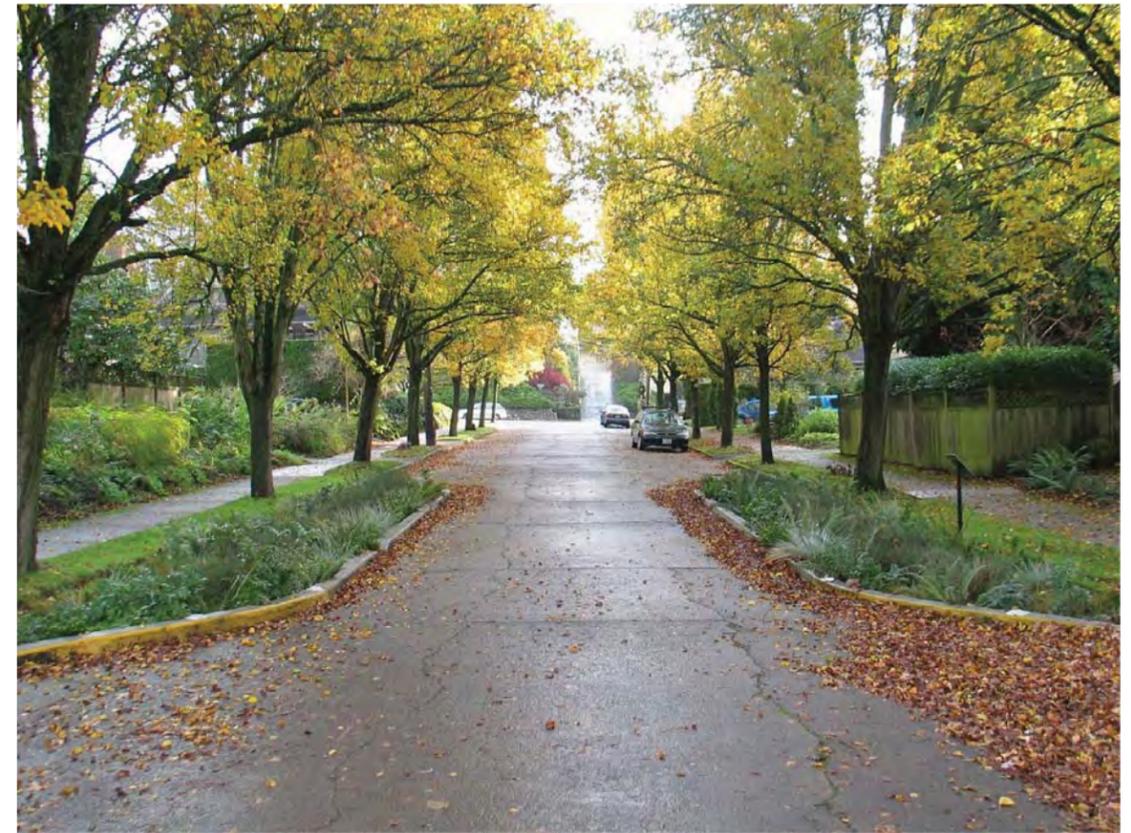


Figure 7.3. FINAL BARTON ALTERNATIVE 4A (GSI): GREEN STORMWATER INFRASTRUCTURE IN SUB-BASIN 416

facilities and the property owners will need to work cooperatively with the County regarding planting, or customization of the rain gardens) and level of maintenance.

7.5 FINAL SHORT-LISTED ALTERNATIVES—MURRAY BASIN

7.5.1 Refinement of Murray Alternatives

The project team and the CAG developed and refined alternatives as described in Section 7.3, resulting in three short-listed alternatives for final evaluation. Table 7.4 summarizes pertinent data; the alternatives are described in detail in the following sections.

	Alternative 1A	Alternative 1F	CAG Alt. 2-a
Type of Facility	Buried, Rectangular Tank,	Buried, Rectangular Tank,	Buried Rectangular Tank in Lincoln Park Lower Parking Lot; Storage pipe at Lowman Park.
Facility Dimensions	72' x 155' area, 15' deep	Cell length varies (180', 150', 120', 95', 60'); cell width 15'; depth 15'	Tank: 76' x 144' are, 20' deep Pipe: 12' diameter 125' length
# Internal Channels	4	5	4 (tank)
Sewer	48" diameter, 80' length; open-cut w diversion structure	48" diameter, 140' length; open-cut w diversion structure	Dual 24" diameter force mains, 600' length; open-cut
Excavation Limits to Shoring	80' x 165' area, 35' deep (max)	100' wide x 190' to 70' long	Tank: ~85' x 152' area, 40' deep (max) Pipe: 20' x 130'
Diversion Control Structure Dims:	31' x 23' area, 25' deep	31' x 23' area, 25' deep	Tank: 31' x 23' area, 25' deep Pipe: 20' x 20'
Odor Control/Electrical Footprint	40' x 40' (below-grade odor control) 12' X 20' (below-grade elect.)	40' x 40' odor control 12' x 20' elect. (both above grade)	40' x 40' (below-grade odor control) 12' x 20' (below-grade elect.)
Land acquisition	25,000 square feet in Lowman Beach Park, easement	20,000 square feet purchased	50,000 square feet in Lincoln Park and right of way near Lowman Beach Park, easements
Construction Limits, Staging	150,000 square feet	85,000 square feet (Contractor to find additional staging off site)	95, 000 square feet
Street Use	See Property Acquisition Plan	See Property Acquisition Plan	See Property Acquisition Plan

7.5.2 Murray Alternative 1A—Storage at Lowman Beach Park

This alternative features a diversion structure, 80 feet of 48-inch-diameter gravity sewer, a 1.0-MG rectangular, buried, cast-in-place concrete storage tank, a tank cleaning mechanism, and submersible pumps for tank draining (see Figure 7.4). The diversion structure would be west of the existing Murray Pump Station, connected near the existing CSO outfall. It would have an overflow weir to divert flows exceeding the pump station's 31.5-mgd capacity through a new 48-inch sewer to the storage tank. The storage tank would retain the overflows until rainfall has ceased for a pre-set time. At that time, submersible drain pumps would pump the stored contents back to the Murray Pump Station over a 12-hour period.

The tank would be located in Lowman Beach Park, adjacent to the existing Murray Pump Station. It would have an area of 72 feet by 155 feet and a water depth of 15 feet. It would be constructed by cut-and-cover methods. A shored excavation in level ground would be required. It is anticipated that the tank would be covered by 2 to 4 feet of earth and the park would be restored on top of the tank. The tank would be accessed from the top at the ends for maintenance. Cleaning equipment would likely consist of either flushing gates or tipping buckets, to be determined during detailed design. A 110-by-25-foot below-grade structure would house carbon scrubber odor control, electrical equipment, and a backup generator.

This alternative was evaluated using the criteria shown in Appendix B. The following sections describe evaluation considerations.

7.5.2.1 Land Use and Permitting

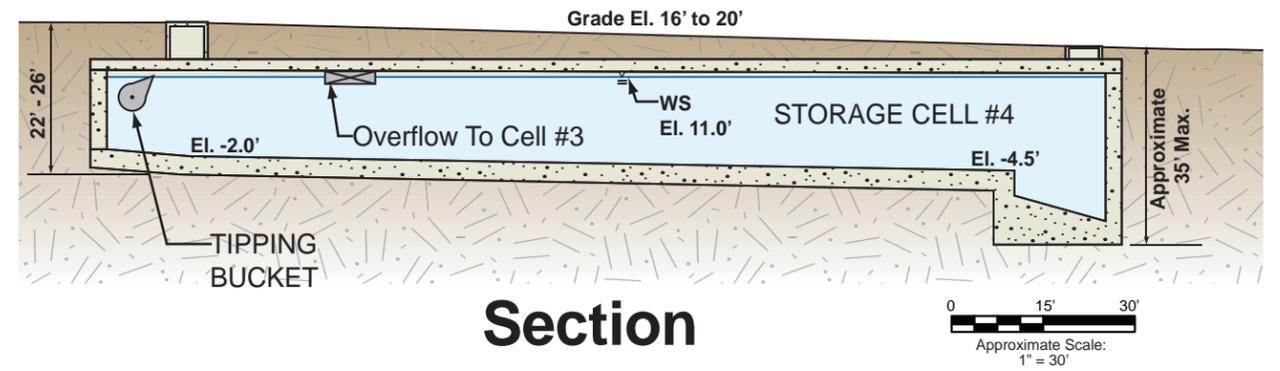
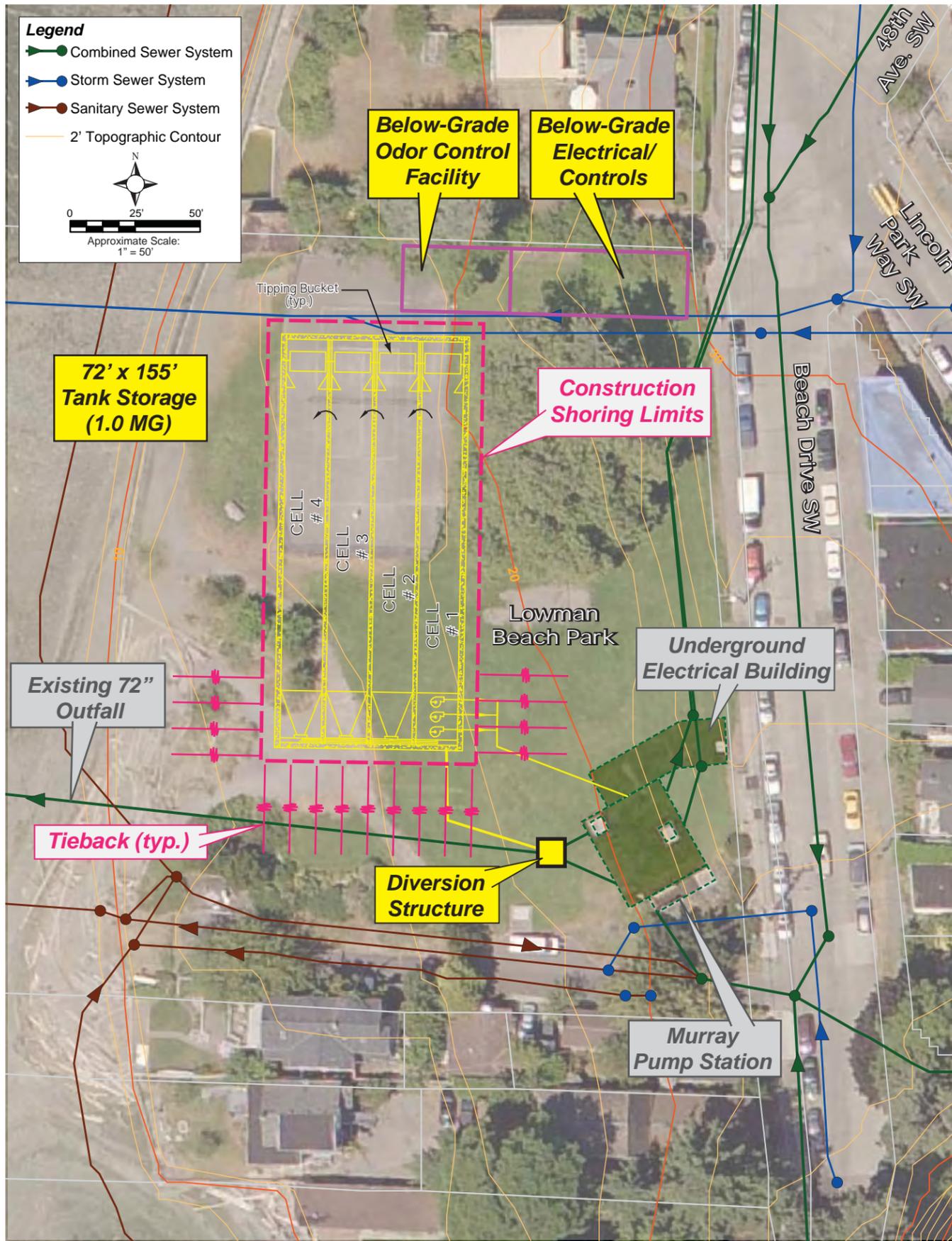
Seattle's comprehensive plan strongly discourages the location of utilities in Seattle parks. The area is zoned single-family residential and the overlying Shoreline designation is Conservancy Recreation (CR). Utility service uses, including storage tanks, are prohibited in the CR zone; allowed uses are limited to utility lines only. City Council and Department of Ecology approval of a code amendment would likely be required.

This alternative would require a Shoreline permit. A piped portion of Pelly Creek runs along the north boundary of the park; a Hydraulic Project Approval may be required if the piped portion needs to be relocated. Construction of this alternative would require careful traffic planning because there is restricted access along Beach Drive for residences south of Lowman Beach Park.

The design would include measures to minimize impacts on existing land use. This alternative is located on park property and would be difficult to mitigate with in-kind replacement (may require acquisition of private properties.). Seattle Ordinance 118477 requires approval from Seattle City Council if King County intends to acquire park property for utility use.

7.5.2.2 Environmental

No archaeological or historic resources have been identified in the project area, but, based on site characteristics, the project area has a high probability of containing such resources.



It is assumed that Pelly Creek is not a fish-bearing stream. Construction and operation of this alternative would have a minimal effect on fish and wildlife and their habitat. Construction would require the removal of two American sycamores and a Douglas fir that appear to meet the definition of exceptional trees under the SMC.

The project area is located within the shoreline zone. Construction on the beach is not anticipated. No wetlands have been identified in the project area.

7.5.2.3 Technical

This is a bottom of the basin alternative and is considered highly reliable in capturing peak flows that exceed the Murray Pump Station's capacity. This alternative requires a simple diversion structure with a weir to divert flows to storage through a gravity pipeline. There is limited room on this site to expand the facility in the future.

There may be construction difficulties with groundwater, liquefaction conditions, and excavation. Space in the park is limited for staging and material lay-down.

7.5.2.4 Operation and Maintenance

Access for tank, odor control and electrical facility maintenance would be straightforward and familiar to County operations staff. The tank and diversion structure would be easily accessed from Beach Drive and there would be adequate space around the tank for maintenance. Maintenance of the odor control and electrical systems would require below-grade entry. Access for major maintenance intervals of the tank would require park closure.

7.5.2.5 Costs

This alternative is the least costly of the short-listed alternatives; at this level of estimating its cost is essentially equal to that of Alternative 1F. See Appendix B for a summary of comparative costs.

7.5.2.6 Community

The community has expressed concern over construction of a storage facility under Lowman Beach Park. Construction at this site would have the following substantial impacts on the community:

- Short-term impacts from approximately 1,150 truck trips for removal of excavated materials and import of construction materials. The haul route would be along Beach Drive, Lincoln Park Way and Fauntleroy Way, which has substantial ferry traffic.
- Loss of park use during construction (24 to 36 months).
- Existing trees in the park may need to be removed to provide room for construction.
- Access hatches and penetrations such as vents may cause reduction in park use.

7.5.3 Murray Alternative 1F—Beach Drive Area Underground Storage

This alternative features a diversion structure, 80 feet of 48-inch diameter gravity sewer and a 1.0-MG rectangular, buried, cast-in-place concrete storage tank with a tank cleaning mechanism and submersible pumps for tank draining (see Figure 7.5). The tank would be located on private properties across Beach Drive from Lowman Beach Park and the existing Murray Pump Station. The tank would have multiple cells and the facility's footprint would be trapezoidal so it could fit on the proposed site. A retaining wall along the east edge of the property (along Lincoln Park Way SW) would provide slope stability and maximize the usable area within the proposed site.

The diversion structure would be located west of the pump station, connected near the existing CSO outfall. It would have an overflow weir to divert flows exceeding the pump station's 31.5-mgd capacity through the 48-inch sewer to the storage facility. The storage facility would retain the stored volume until rainfall has ceased for a pre-set time. At that time, submersible drain pumps would pump the stored contents back to the Murray Pump Station over a 12-hour period.

The tank would consist of five 15-foot-wide cells, from 60 to 180 feet long. It would be constructed by cut-and-cover methods, with secant-pile shoring on all sides. The tank would be covered by 2 to 4 feet of earth and the surface would be restored on top of the tank. A 40-foot by 60-foot above-grade structure would house carbon scrubber odor control, electrical equipment, and a backup generator. The tank would be accessed from the top at the ends of each cell for maintenance. Cleaning equipment would likely consist of either flushing gates or tipping buckets, to be determined during detailed design.

Restoration requirements over the tank area and adjacent to the existing pump station would be established during final design.

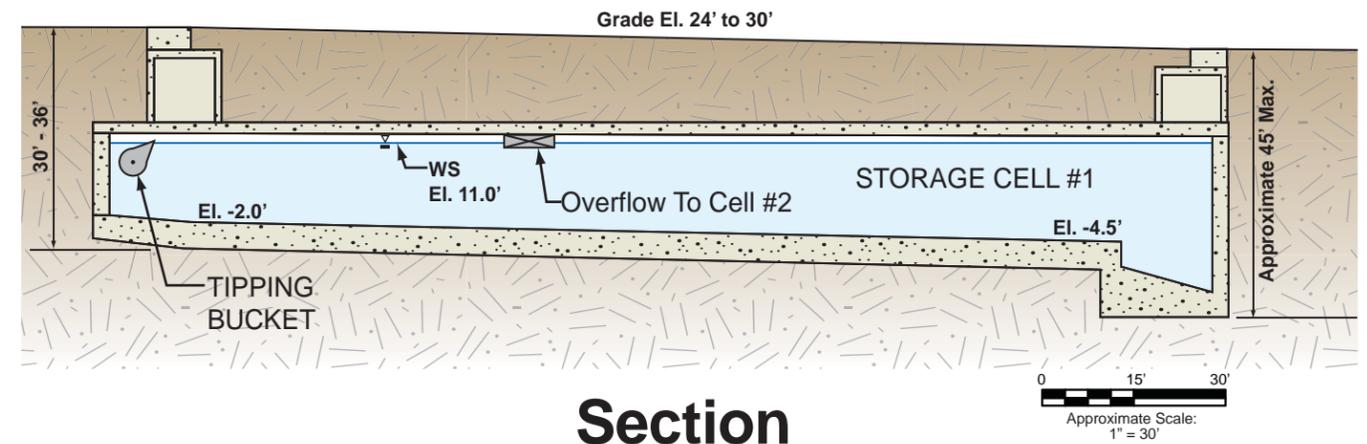
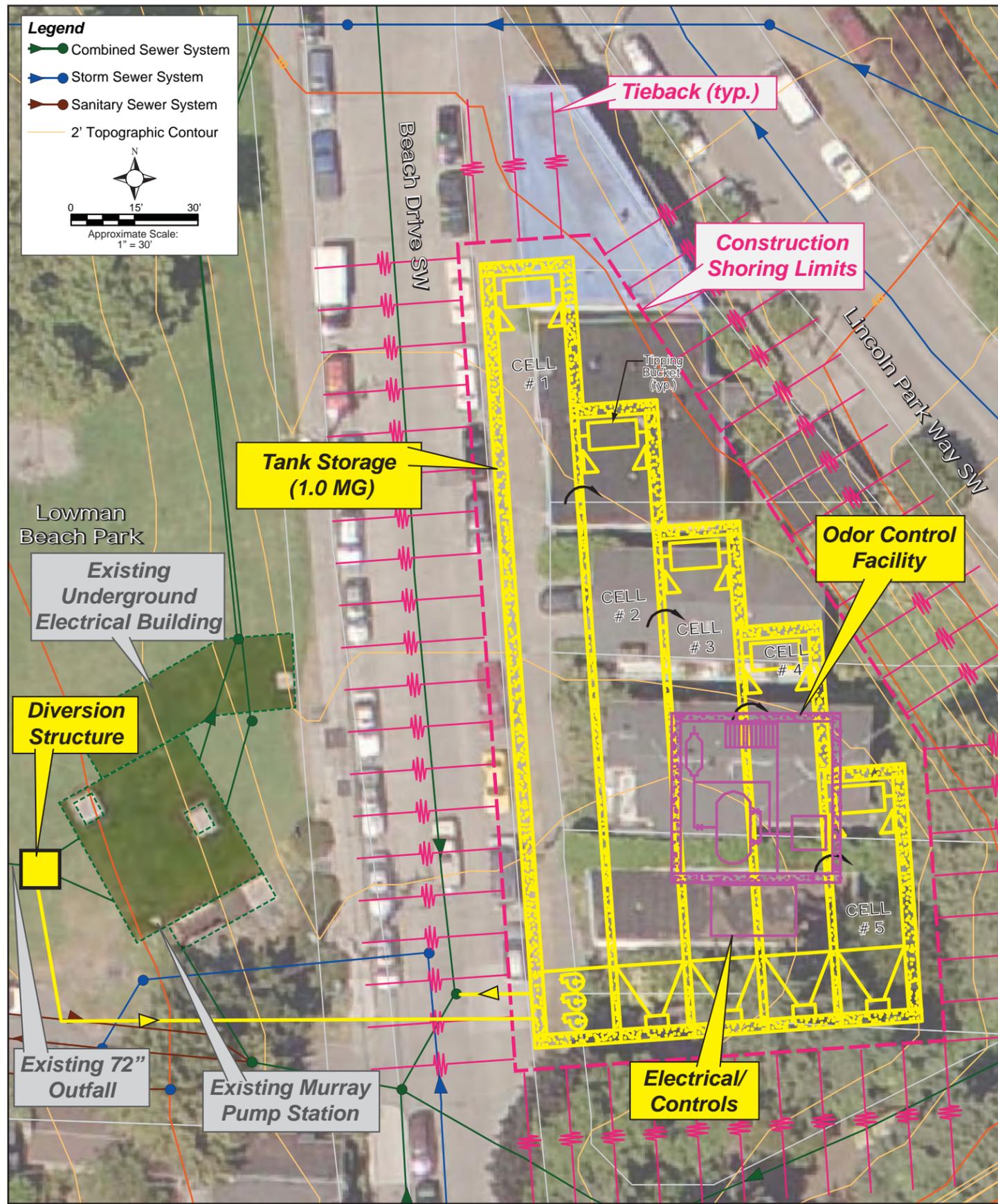
This alternative was evaluated using the criteria shown in Appendix B. The following sections describe evaluation considerations.

7.5.3.1 Land Use and Permitting

Construction of this alternative would require property acquisition and demolition of six residential structures. Construction of the diversion structure west of the existing pump station in Lowman Beach Park would require approvals from Seattle Parks and the Seattle Department of Planning and Development (DPD).

The diversion structure would be located within the Shoreline District and will likely be considered an expansion of the existing pump station facility. The storage tank would be located outside the shoreline zone.

It is anticipated that one discretionary Shoreline permit would be required. Local permits would be required from SDOT and DPD. A parks review would also be required. It is anticipated that no federal or state permits would be required. Because of temporary traffic impacts during construction for local residents, provisions for temporary and emergency access would be required as a permit condition.



Section

Figure 7.5.
FINAL MURRAY ALTERNATIVE 1F: BEACH DRIVE AREA UNDERGROUND STORAGE

3630023/Fig7-05_Murray_Final1F.ai

7.5.3.2 Environmental

No archaeological or historic resources have been identified in the project area, but based on site characteristics, the project area has a high probability of containing such resources.

Construction of this alternative would require clearing of forested area on the private properties, which may affect fish and wildlife. There are large Douglas fir trees and a flowering cherry tree on the site, which may meet the definition of exceptional trees in SMC.

Part of this project is located within the Shoreline zone. Construction on the beach is not anticipated. No wetlands have been identified in the project area.

7.5.3.3 Technical

This is a bottom-of-the-basin alternative and would be highly reliable in capturing peak flows that exceed the Murray Pump Station's capacity. This alternative requires a simple diversion structure with a weir to divert flows to storage through a gravity pipeline. There is limited room on the site to expand the facility in the future.

There may be construction difficulties with groundwater, liquefaction conditions, and excavation. It is anticipated that a secant pile shoring system and a retaining wall for Lincoln Park Way SW would need to be constructed to effectively use the site and construct the storage facility. Construction staging and lay-down in portions of the park would be required. Electrical and odor control facilities can be located at grade, on top of the tank.

7.5.3.4 Operation and Maintenance

Access for tank, odor control and electrical facility maintenance is straightforward and familiar to County operations staff. The tank and diversion structure would be easily accessed from Beach Drive and there would be adequate space around the tank for maintenance. Maintenance of the odor control and electrical systems would use above-grade entry. Access for major maintenance intervals of the tank would not require park closure.

7.5.3.5 Costs

This alternative is the second least costly of the short-listed alternatives; at this level of estimating its cost is essentially equal to that of Alternative 1A. See Appendix B for a summary of comparative costs.

7.5.3.6 Community

The community has expressed concern about construction of a storage facility on private properties at the bottom of the basin because of the concern for removing housing. Construction at this site would have the following substantial impacts on the community:

- Requires the acquisition of six residential properties and the relocation of 15 residents.
- Short-term impacts from approximately 1,500 truck trips for removal of excavated materials and import of construction materials. The likely haul route would be along

Beach Drive, Lincoln Park Way, and Fauntleroy Way, which has substantial ferry traffic.

- Intermittent loss of park use and some limits to park access during construction (12 to 24 months).

7.5.4 Alternative CAG 2-a—Storage at Lincoln Park Lower Parking Lot

This alternative features two storage facilities: a 1.25-MG buried rectangular storage tank under Lincoln Park's lower parking lot (near the far south end of the park); and a 0.1-MG, 12-foot-diameter storage pipe at the bottom of the Murray basin adjacent to the existing pump station, most likely in Beach Drive (see Figure 7.6.). For the Lincoln Park storage facility, there would be a force main diversion to the facility off the existing Barton Pump Station force mains. There would be tank-cleaning mechanisms and submersible pumps for tank draining. For the pipe storage adjacent to the Murray Pump Station, there would be a gravity diversion structure, a flushing gate mechanism for cleaning, and submersible pumps for tank draining.

When flows to the Murray Pump Station approach a level at which an overflow is likely to occur (estimated near 15 mgd since approximately half of the flow during a peak event is coming from the Barton Pump Station to the Murray Pump Station), flows from the Barton Pump Station would be diverted to the storage facility in Lincoln Park, so that only flows from the Murray CSO basin would continue to the Murray Pump Station. Excess flows beyond the Murray Pump Station's 31.5-mgd capacity would be diverted through a 48-inch sewer to the new large-diameter storage pipe at the bottom of the Murray basin. Both storage facilities would retain stored flows until rainfall has ceased for a pre-set time. At that time, submersible drain pumps would pump the stored contents back in to the Barton Pump Station force main and Murray Pump Station over a 12-hour period.

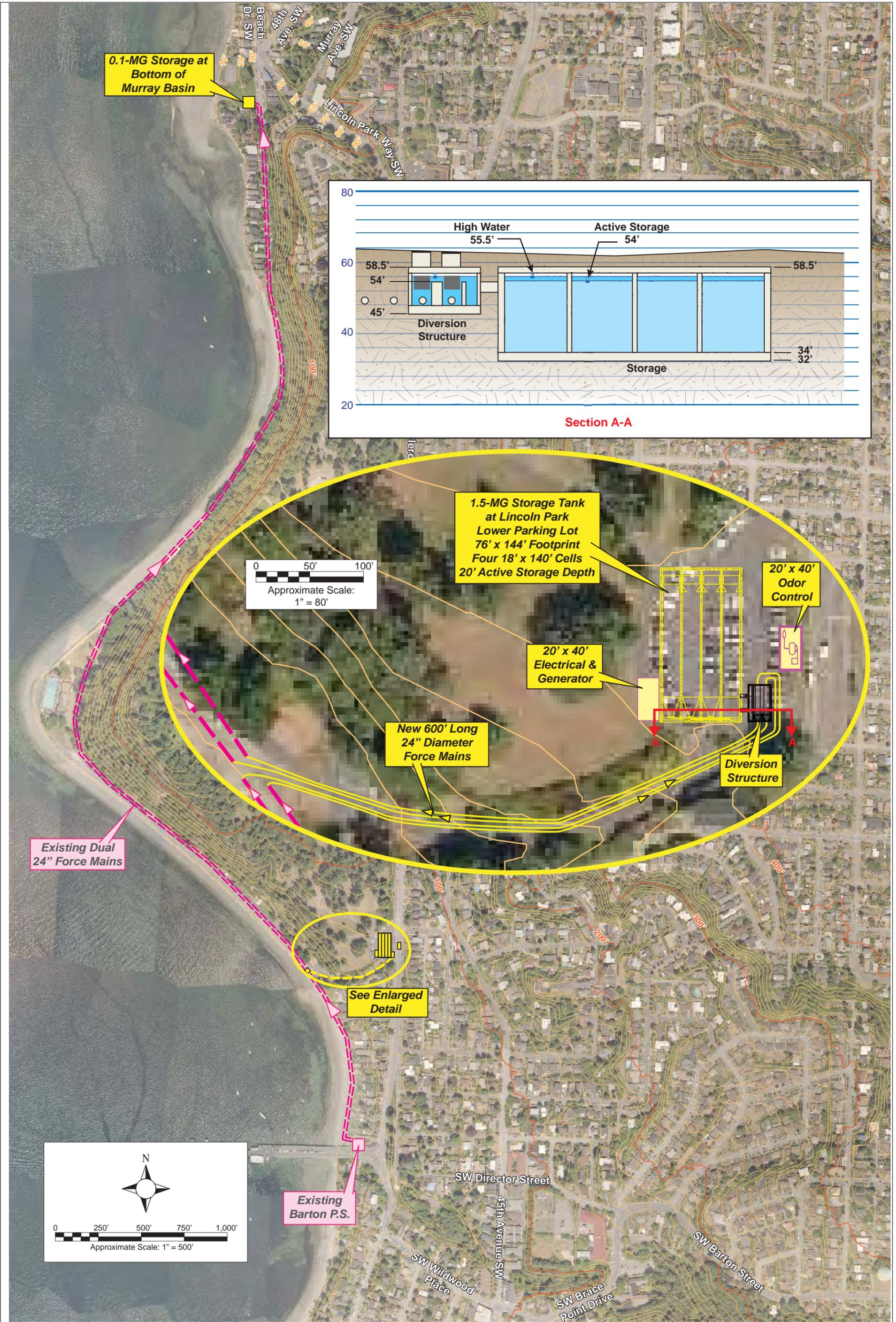
The Lincoln Park tank would have an area of 76 feet by 144 feet and a water depth of 20 feet. A shored excavation in level ground would be required. The tank would be covered by 4 to 8 feet of earth and the parking lot would be restored on top of it. Separate 20-by-40-foot below-grade structures would house the electrical facilities and the carbon scrubber odor control facility. The large-diameter storage pipe adjacent to Lowman Beach Park would be 125 feet long and would have a below-grade or above-grade odor control and electrical facility, depending on where it was sited. The odor control and electrical facilities would both have dimensions of approximately 20 feet by 40 feet.

The storage facilities would be accessed from the top at the ends for maintenance. Cleaning equipment would likely consist of either flushing gates or tipping buckets, to be determined during detailed design.

This alternative was evaluated using the criteria shown in Appendix B. The following sections describe evaluation considerations.

7.5.4.1 Land Use and Permitting

The project area is zoned single-family residential and a conditional use permit may be required for constructing utility services within the park. Seattle's comprehensive plan



strongly discourages the location of utilities in city parks. The Shoreline designation is Conservancy Recreation (CR) and Conservancy Preservation (CP). Utility lines are allowed as a special use within the CR designation, but are prohibited in the CP designation. An approval from Seattle Parks and Recreation would be required to allow a utility service use (storage tank) beneath the parking lot of Lincoln Park. The storage tank would be located outside of the Shoreline District and would be allowed through a City Council Conditional Use Approval, provided the parks department approves of the project.

7.5.4.2 Property Acquisition

This alternative is located on park property and may be difficult to mitigate with in-kind replacement. Sections of Lincoln Park and the parking lot would be needed for permanent easements and temporary easements. Seattle Ordinance 118477 requires approval from the Seattle City Council if King County intends to acquire the park property for utility use.

7.5.4.3 Environmental

No archaeological or historic resources have been identified in the project area, but based on site characteristics, part of the project area has a high probability of containing archaeological resources. The Lincoln Park Concession & Comfort Station is located more than 200 feet northwest of the lower parking lot but would not be impacted by the project. No historic resources have been identified in other project areas.

The project area is located within the shoreline zone (diversion structures and force main). Construction on the beach is not anticipated. No wetlands have been identified in the project area.

7.5.4.4 Technical

This alternative requires siting storage at two locations in order to achieve control at the Murray Pump Station. Diverting flows to the storage facility at the bottom of the Murray basin would be by gravity overflow and would be highly reliable. Diverting flows to storage at Lincoln Park would use a complex diversion structure relying on telemetry and possibly predictive algorithms. Telemetry signals would activate motorized gates (or valves) to divert flow to storage during a peak flow event. There would be continuous need for air management at the diversion structure because force main flows would be released to atmosphere in the storage facility.

This alternative would require an emergency overflow in the event of telemetry and control failure; the overflow would likely be routed to the existing SPU sewer in Fauntleroy Way (or a new overflow pipe back to the Barton Pump Station would need to be constructed). There is limited space available in Lincoln Park's lower parking lot for expansion of the tank if additional capacity is needed. Property is limited at the bottom of the basin and ability to expand the smaller 0.1 MG storage facility in the future could also be problematic.

7.5.4.5 Operation and Maintenance

Operation and maintenance of rectangular and pipe storage facilities is familiar to King County staff. However, King County operations staff has limited familiarity with predictive algorithms used to divert flow to storage to prevent CSOs.

Maintenance of the odor control and electrical systems would require below-grade entry. Access for major maintenance intervals of the tank would require parking lot closure and street closure along Beach Drive.

7.5.4.6 Costs

This alternative is the most costly of the short-listed alternatives; but at this level of estimating its cost is essentially equal to that of Alternative 1A and Alternative 1F.

7.5.4.7 Community

The Barton and Murray communities have been split with support for or concerns about this alternative. The Murray community is more supportive of this alternative because it lessens the impact on Lowman Beach Park and properties at the bottom of the Murray Basin. The Barton community is concerned about the loss of use of the Lincoln Park lower parking lot during construction, 5 to 7 years of multiple construction projects in the immediate vicinity, and limitations to parking during heavy maintenance intervals in the future. Construction at this site would have the following substantial impacts on the community:

- Short-term impacts from approximately 2,000 truck trips for removal of excavated materials and import of construction materials. The haul routes would be along Beach Drive, Lincoln Park Way, and Fauntleroy Way, which has substantial ferry traffic.
- Loss of park use during construction (24 to 36 months).
- Trees in Lincoln Park may need to be removed to provide room for construction.
- Access hatches and penetrations such as vents may result in permanent loss of some parking spaces.

7.6 SELECTION OF PROPOSED PROJECTS

This section describes the selection of the proposed project for the Barton and Murray CSO basins. Detailed evaluation matrices are provided in Appendix B.

7.6.1 Refinement of the Evaluation Criteria

The evaluation template used by the project team to evaluate these alternatives is in Appendix B. It describes the team's comments on the various factors affecting selection of the proposed projects.

7.6.2 Evaluation Process

7.6.2.1 Screening Analysis

The project team convened several focus group meetings between May 2010 and October 2010. The team reviewed updated and new information about the alternatives. The team refined the criteria questions and evaluation ratings using the results of these meetings.

The team then compiled evaluation results from the focus group meetings and convened two workshops in November 2010 to condense the most salient evaluation factors to carry forward to King County management to assist in making a final selection. Tables 7.5 and 7.6 summarize the project team’s analysis of the shortlisted alternatives for Barton and Murray.

7.6.2.2 Risk Analysis

In November 2010, the project team conducted project implementation risk assessment workshops for the short-listed alternatives. The resulting risk assessment matrices are in Appendix G. For the Barton CSO basin, Alternatives 1E and 1F had a number of potential high-impact and high-probability risks, as shown in Table 7.5. For the Murray CSO basin, Alternatives 1A, 1F, and CAG 2-a all had a number of potential high-impact and high-probability risks, as shown in Table 7.6. These risks result in higher cost and schedule risk for these alternatives.

Barton Alternative 4A (GSI) had no identified high-probability/high-impact risks.

Table 7.5 Barton Short Listed Alternatives Evaluation Summary Data			
	Alternative 1E: Pipe Storage in Upper Fauntleroy Way	Alternative 1F: Tank Storage at Fauntleroy School	Alternative 4A: GSI in Sub-basin 416
Overall Evaluation Ratings	This alternative had the fewest low-impact scores and had some high impact ratings.	This alternative had the most mid-impact ratings and scored in the middle for low-impact ratings.	This alternative had the most low-impact ratings.
Technical Considerations	Mid-basin alternative that requires careful management of flows to ensure CSO control. Storage pipe and infrastructure similar to other county facilities. Shoring, groundwater, and physical space concerns for constructability. Street access required. Increased staffing and maintenance requirements for facilities in the right-of-way and cleaning of pipe configuration.	Mid-basin alternative that requires careful management of flows to ensure CSO control. Buried rectangular storage tank similar to other county facilities. Street access required for maintenance of drop structure and diversion structure. Concern about staff safety and street closure requirements.	Technically the simplest alternative—no wastewater equipment. This alternative has opportunity to expand for additional removal of impervious area flows. No significant construction issues or risks beyond typical landscape construction in right-of-way. Routine landscape maintenance and inspection required.

**BARTON AND MURRAY COMBINED SEWER OVERFLOW CONTROL FACILITIES PLAN
ALTERNATIVES EVALUATION AND SELECTION**

Table 7.5 Barton Short Listed Alternatives Evaluation Summary Data

	Alternative 1E: Pipe Storage in Upper Fauntleroy Way	Alternative 1F: Tank Storage at Fauntleroy School	Alternative 4A: GSI in Sub-basin 416
Preliminary Cost Estimates			
Project	\$7,820,000	\$8,600,000	\$12,000,000 - \$14,800,000
Land (including easements)	\$0	\$740,000	\$0
Street Use Permits	\$1,200,000	\$185,000	\$1,200,000
Total	\$9,020,000	\$9,525,000	\$13,200,000 - \$16,000,000
Community Input	Strong opposition to this alternative.	Support for this alternative from Fauntleroy Community Association, some concerns about temporary parking impacts from tenants.	Although some community members have expressed support for this alternative, some have also raised concerns about increased risk of water intrusion into basements.
Real Estate	Concerns about loss of trees and impacts on view from Upper Fauntleroy Way. May need private acquisition if additional space required to accommodate project.	Property owner amenable to providing an easement for siting the tank in the parking lot.	Concerns about loss of parking. Curb bulbs would be at end of blocks where parking is already prohibited.
Land Use, Permits (in addition to typical construction permits)	SDOT street use permit. Local construction permits. Exceptional tree permit.	Council Conditional Use Permit – review process would probably be straightforward. There is community support for this alternative.	SDOT street use (street improvement permit).
Environmental Considerations	Significant archaeological concerns.	Based on site characteristics, site has medium potential to contain archaeological resources.	No known environmental, issues of concern.
Risk Analysis High Impact and High Probability Risks	Archaeological resources found during construction, delaying project. Community protests removal of treasured roses and exceptional trees to County and City Council, delaying project.	Tenant at Fauntleroy School objected to use of site because of fear of loss of business, delaying project.	No 'high-high' risks were identified during the risk analysis.

**BARTON AND MURRAY COMBINED SEWER OVERFLOW CONTROL FACILITIES PLAN
ALTERNATIVES EVALUATION AND SELECTION**

Table 7.6 Murray Short Listed Alternatives Evaluation Summary Data

	Alternative 1A: Rectangular Storage in Lowman Beach Park	Alternative 1F: Beach Drive Area Underground Storage	CAG Alt. 2-a: Storage in Lincoln Park Lower Parking Lot
Overall Evaluation Ratings	This alternative had the most high-impact ratings.	This alternative had a mixture of mostly mid-impact and low-impact ratings.	This alternative had a mixture of mostly high-impact and mid-impact ratings.
Technical Considerations	Bottom-of-the-basin alternative that is the most reliable for capturing peak flows and ensuring CSO control. Buried rectangular storage tank similar to other county facilities. Shoring, groundwater, and physical space concerns for construction in park.	Bottom-of-the-basin alternative that is the most reliable for capturing peak flows and ensuring CSO control. Buried rectangular storage tank similar to other county facilities. Shoring, groundwater, and physical space concerns for construction on a small site without spare space for lay-down and staging.	Technically the most complicated alternative—Storage at two locations relying on telemetry and predictive control algorithms to divert flow to storage. Air management would be a challenge at the Lincoln Park parking lot storage tank. Emergency overflow to local sewer required. Fewer groundwater and excavation issues than at the bottom of the basin locations.
Preliminary Cost Estimates			
Project	\$29,800,000	\$32,900,000	\$42,800,000
Land Acquisition (including easements)	\$9,000,000	\$6,400,000	\$1,800,000
Street Us Permits	\$1,800,000	\$1,700,000	\$140,000
Total	\$40,600,000	\$41,000,000	\$44,740,000
Community Input	Strong opposition to this alternative. Seattle Ordinance 118477 requires council approval for construction in the park. Council decision is appealable.	Strong opposition by some community members.	Strong opposition to this alternative. Seattle Ordinance 118477 requires council approval for construction in the park. Council decision is appealable.
Real Estate	Concerns about loss of trees and impacts on view from Lowman Beach Park. Use of park.	Some property owners may not be willing to sell, which would require condemnation under eminent domain. Relocation of tenants.	Concerns about loss of parking and park use/access.

**BARTON AND MURRAY COMBINED SEWER OVERFLOW CONTROL FACILITIES PLAN
ALTERNATIVES EVALUATION AND SELECTION**

Table 7.6 Murray Short Listed Alternatives Evaluation Summary Data

	<u>Alternative 1A:</u> Rectangular Storage in Lowman Beach Park	<u>Alternative 1F:</u> Beach Drive Area Underground Storage	<u>CAG Alt. 2-a:</u> Storage in Lincoln Park Lower Parking Lot
Land Use, Permits (in addition to typical construction permits)	Exceptional tree permit. Shoreline Permit Council Conditional Use Permit with DOE approval — The storage tank would be located in a city park designated “Conservancy Recreation” (CR) in Seattle’s Shoreline Master Program. Storage is considered a “Utility Service Use.” Utility Service Uses are prohibited.	Storage tank in Low-rise Multi-family zoning is allowed if construction can meet same standards identified for Institutions. Utility pipelines and associated underground diversion structure within the park would require a Shoreline Permit.	Council Conditional Use Permit. The storage tank would be located in a city park. The zoning is single-family residential and the overlying Shoreline designation is Conservancy Recreation (CR) and Conservancy Preservation (CP). Storage is considered a utility service use, which is allowed through City Council Conditional Use approval. Storage tanks are prohibited within the CR and CP Shoreline designation but utility pipelines are allowed as a special use.
Environmental Considerations	High probability for site to contain archaeological resources. No anticipated impacts on Pelly Creek.	Site has medium probability of containing archaeological resources. Construction would take place next to steep slopes.	No known archaeological sites but high probability of encountering resources in the proposed locations. Some construction within Shoreline but no construction in beach.
Risk Analysis High Impact and High Probability Risks	Permit appeal successful, delaying project. Rezoning required, delaying project. Park trees need to be removed, delaying project. Community successfully protests project, causing delays.	Differing site conditions encountered during excavation. Replacement of property substantially more expensive than planned.	Permit appeal successful, delaying project. Limited haul routes require substantial restoration and limitations on work hours, delay project completion and high expense. Loss of hydraulic capacity of Barton Pump Station because of flow transition to new storage facility, increase tank size and cost. Community successfully protests project, causing delays.

7.7 PROPOSED ALTERNATIVES FOR FURTHER ENVIRONMENTAL REVIEW

The project team forwarded five alternatives, along with briefings and summary key evaluation considerations, to King County management for a final decision to move forward for further environmental review:

- For the Barton CSO basin:
 - Alternative 1F—Storage at Fauntleroy School
 - Alternative 4A—Green Stormwater Infrastructure
- For the Murray CSO basin:
 - Alternative 1A—Storage in Lowman Beach Park
 - Alternative 1F—Beach Drive Area Underground Storage
 - Alternative CAG 2-a—Storage in Lincoln Park Lower Parking Lot

King County management selected the following as proposed alternatives for further environmental review:

- Barton Alternative 4A—Green Stormwater Infrastructure. This alternative was selected for the following reasons:
 - Least complex approach for reducing CSOs.
 - Reduces the total volume of stormwater that needs to be conveyed and treated in the regional system.
 - Response to the interests from some community members in green infrastructure
 - Minimal permitting/zoning issues.
 - Property acquisition not required if all work is within right-of-way.
- Murray Alternative 1F—Beach Drive Area Underground Storage. This alternative was selected for the following reasons:
 - Simple, reliable system in which gravity diversion of flow fills the storage tank.
 - Does not involve tank construction on park property.
 - Minimal permitting/zoning issues.
 - Lowest schedule and cost risk.

Chapter 8 describes the proposed alternatives in detail.