

Barton, Murray, Magnolia and North Beach CSO Projects  
Alternatives Analysis

MURRAY BASIN ALTERNATIVES

CATEGORY / CRITERIA	1A: RECTANGULAR STORAGE, BOTTOM OF BASIN		ALTERNATIVE 1B: CIRCULAR STORAGE, MURRAY AVE & LINCOLN PARK		ALTERNATIVE 1C: DIST. STORAGE BEACH DRIVE & MURRAY AVE	
	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION
<b>ENVIRONMENT</b>						
1. Cultural Resources	2	No archaeological or historic resources identified in the project area. Based on site characteristics, the project area has a high probability of containing archaeological resources.	2	No archaeological or historic resources identified in the project area. Based on site characteristics, the project area has a high probability of containing archaeological resources.	2	No archaeological or historic resources identified in the project area. Based on site characteristics, the pipe storage area in Beach Drive SW has a high probability of containing archaeological resources. The pipe storage area in Murray Ave. SW has a low probability for containing archaeological resources.
2. Fish and Wildlife	3	It is assumed that Pelly Creek is not a fish-bearing stream. Construction and operation of this alternative would not affect fish and wildlife, or their habitat. If marine access was required, rating would change from 3 to 1.	2	It is assumed Pelly Creek is not a fish-bearing stream. Construction would require clearing of forested area, which may affect fish and wildlife. If marine access was required, rating would change from 2 to 1.	3	Construction and operation of this alternative would not affect fish and wildlife or their habitat.
3. Wetlands, Streams, and Shoreline	2	It is assumed that Pelly Creek, which is piped through the project area along the northern edge of Lowman Beach Park, would likely have to be moved to construct this alternative. It is assumed that marine access would not be required. If marine access was required, construction would impact Puget Sound shoreline and rating would change from 2 to 1. No wetlands in the project area.	1	Pelly Creek flows through the project area and would be impacted by construction activities. The project area may contain wetlands that would be impacted by construction activities. This alternative would not impact shoreline areas.	2	It is assumed that Pelly Creek, which is piped through the project area, would likely have to be moved to construct this alternative. This alternative would not impact wetlands or shoreline areas.
4. Soils and Sediments	3	No known contaminated sites. Project area is within liquefaction zone. No steep slopes and/or potential or known landslide areas.	1	No known contaminated sites. Eastern part of project area has steep slopes and is identified as a potential landslide area. Project area is not within liquefaction zone and contains no known landslide areas.	3	No known contaminated sites. Project area is not within liquefaction zone and contains no steep slopes and/or potential or known landslide areas. Murray Avenue SW is adjacent to steep slopes.
5. Water Quality	3	No new untreated discharges to surface waters.	3	No new untreated discharges to surface waters.	3	No new untreated discharges to surface waters.



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	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION
<b>TECHNICAL</b>						
1. Technical Complexity	3	At bottom of basin and will capture peak flow using a weir in a diversion structure. Most reliable and will not require telemetry to divert flows.	2	Mid-Basin Alternative but close to bottom of the basin. Will require some telemetry and possibly predictive algorithms. Considered more reliable since close to the bottom of the basin.	2	Mid-Basin Alternative/Distributed Storage but close to bottom of the basin. Will require some telemetry and possibly predictive algorithms. Considered more reliable since close to the bottom of the basin.
2. Compatibility with Existing WW system	2	May prolong peak event to existing system because stored flows will be fed back into the system after peak event passes. More pounds of BOD, TSS will be routed through treatment facilities.	2	May prolong peak event to existing system because stored flows will be fed back into the system after peak event passes. More pounds of BOD, TSS will be routed through treatment facilities.	2	May prolong peak event to existing system because stored flows will be fed back into the system after peak event passes. More pounds of BOD, TSS will be routed through treatment facilities.
3. Flexibility/Adaptive Management	2	Limited space available for expansion or construction of auxillary tank. Property is limited at the bottom of the basin and ability to expand in the future could be problematic.	2	Limited space available for expansion or construction of auxillary tank. Property is limited at the bottom of the basin and ability to expand in the future could be problematic.	2	Ability to expand in the R/W is limited because of space and ground surface restrictions. Ability to lengthen pipe limited because of steep excavation depths north and south of the placement area.
4. Constructability/Implementation Schedule	2	There may be construction difficulties with groundwater and excavation. Limited construction access and issues associated with ferry traffic.	2	There may be construction difficulties with groundwater and excavation. Limited construction access and issues associated with ferry traffic.	2	There may be construction difficulties with groundwater and excavation. Limited construction access and issues associated with ferry traffic.



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	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION
<b>O&amp;M</b>						
1. Staffing	3	Facility can be automatically started (gravity overflow) and run autonomously under design conditions. Minimal staffing required for operation and shut down. Some staffing/supervision may be needed for cleaning. Facility should not impact downstream facilities.	2	Facility can be automatically started (gravity overflow) and run autonomously under design conditions. Minimal staffing required for operation and shut down. Some staffing/supervision may be needed for cleaning. Facility should not impact downstream facilities.	3	Facility can be automatically started (gravity overflow) and run autonomously under design conditions. Minimal staffing required for operation and shut down. Some staffing/supervision may be needed for cleaning. Facility should not impact downstream facilities.
2. Training	3	Staff familiar with storage facilities and technology - North Creek. Similar control approaches to other facilities within the system can be specified for consistency.	3	Staff familiar with storage facilities within the system. There are no other circular storage tanks in the KC system.	3	Staff familiar with storage facilities and technology - Henderson & Mercer Street Tunnel. Similar control approaches to other facilities within the system can be specified for consistency.
3. Reliability	3	System is not complex. Gravity diversion over a weir. Power not critical for ability to store peak flows. Storage is a proven technology for controlling peak flow events.	2	System is not complex. Gravity diversion over a weir to storage facility. Power not critical for ability to store peak flows. Storage is a proven technology for controlling peak flow events. Reliance on peak flow pump station send excess Barton flows to storage reduces overall reliability.	2	Access to pipe storage on Beach drive is not complex. Gravity diversion over a weir. Power not critical for ability to store peak flows. Storage is a proven technology for controlling peak flow events. Diversion to storage on Murray Avenue will be by telemetry and gates which may be more complex and less reliable
4. Maintenance	3	Alternative requires less maintenance than other alternatives. Automatic flushing gates should provide most, if not all, the cleaning needed. Minimal telemetry/controls to maintain (typical level sensing and pump system controls). Assumes no entry.	2	Alternative requires less maintenance than other alternatives. Automatic flushing gates should provide most, if not all, the cleaning needed. Minimal telemetry/controls to maintain (typical level sensing and pump system controls). Assumes no entry.	2	Alternative requires less maintenance than other alternatives. Automatic flushing gates should provide most, if not all, the cleaning needed. Minimal telemetry/controls to maintain (typical level sensing and pump system controls). Assumes no entry.
5. Safety	3	No street access required. No traffic control procedures required. No street use/closure permit required.	3	No street access required. No traffic control procedures required. No street use/closure permit required.	1	Street access required. Traffic control procedures required. Street use/closure permit required. Heavily travelled roadway. Rating would change from 1 to 2 if maintenance access can be moved outside of the travelled right-of-way.



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	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION
<b>COST EFFECTIVENESS</b>						
1. Project Capital Costs	3	Relative cost = 1.0	3	Relative cost = 1.2	2	Relative cost = 1.7
2. Life Cycle Costs						
3. Cost Variability/Risk	3	Variability Ratio = 1.4	3	Variability Ratio = 1.1	3	Variability Ratio = 1.1
Note: Project Capital Costs for Murray Alternatives range from a low \$13M to a high of \$70M						
<b>COMMUNITY IMPACT</b>						
1. Location	2	Small, above ground facilities and vents may cause limited reduction in land use. Design must consider surrounding land use. If the facility is built across the street from the park, it should be rated a 2. If it is built in Lowman Park it should be rated a 1.	2	Small, above ground facilities and vents may cause limited reduction in land use. Design must consider surrounding land use.	3	Facility does not impede land use.
2. Potential Community Impacts	3	Similar nearby facilities and design can help small aboveground facilities fit into community vision that is consistent with current surrounding uses. If built across the street from the park it should be rated a 3, if built in the park, a 2.	2	Design can help small aboveground facilities fit into community vision that is consistent with current surrounding uses.	3	Does not change community vision of itself as facilities in street.
3. Construction Impacts	2	Park users will be affected by construction traffic and noise. Some aspects of construction can be reduced through design and construction controls. If constructed in across from the park, it should be rated a 2. If built in Lowman park, it should be a 1.	2	Construction traffic and hauling will use residential arterials. Wooded area provides visual buffer from nearby residences. Some aspects of construction can be reduced through design and construction controls.	1	Construction duration, access limitations, and traffic disruption as well as utilities relocations will adversely impact up to 40 residences, commuter traffic, emergency vehicle access. Construction controls used to reduce impacts will be difficult to implement.



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CATEGORY / CRITERIA	ALTERNATIVE 1D: BOTTOM OF BASIN - TUNNELING		1E: UPPER BASIN STORAGE		1F: BOTTOM OF BASIN - COMBINED PIPE/RECTANGULAR STORAGE	
	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION
<b>LAND USE AND PERMITTING</b>						
1. City of Seattle Comprehensive Plan	2	Section 6.5 of the Seattle Comprehensive Plan (Utilities Element of the Planning Policies, U16) states that the City should work cooperatively with King County to identify and expeditiously address combined sewer overflows. Elsewhere in the Comp Plan (Land Use Element, Section 2.1, LU 61 & 62), uses in Single Family Residential neighborhoods should affirm and encourage residential use by one household as the principal use or should only encourage uses that are permitted outright. Storage is compatible with existing land use within ROW, but may not be fully consistent with Seattle Parks policies for ancillary structures if located in Lowman Beach Park.	1	Section 6.5 of the Seattle Comprehensive Plan (Utilities Element of the Planning Policies, U16) states that the City should work cooperatively with King County to identify and expeditiously address combined sewer overflows. Elsewhere in the Comp Plan (Land Use Element, Section 2.1, LU 61 & 62), uses in Single Family Residential neighborhoods should affirm and encourage residential use by one household as the principal use or should only encourage uses that are permitted outright. Location may require review for consistency with City parks policies. If the storage facility is not located in the park, the rating would be improved.	2	Section 6.5 of the Seattle Comprehensive Plan (Utilities Element of the Planning Policies, U16) states that the City should work cooperatively with King County to identify and expeditiously address combined sewer overflows. Elsewhere in the Comp Plan (Land Use Element, Section 2.1, LU 61 & 62), uses in Single Family Residential neighborhoods should affirm and encourage residential use by one household as the principal use or should only encourage uses that are permitted outright. Storage is compatible with existing land use within ROW, but may not be fully consistent with Seattle Parks policies for ancillary structures if located in Lowman Beach Park.
2. Seattle Municipal Code (SMC/Zoning Code)	3	Utilities would be buried underground in the ROW which would only temporarily disrupt public access. Zoning: N/A (Located in ROW).	2	Zoning is Single Family Residential. Lowman Beach Park in potential placement area will require review for consistency with Parks policies. Dependent upon final location of pump station.	2	In Shoreline zone. Storage tank in Single Family Residential zone; storage pipe in R/W.
3. Shoreline Master Program Compatibility	3	Utilities would be buried underground in the ROW which would only temporarily disrupt public access. Parts of alternative may be in the Shoreline Zone.	1	Storage is compatible with existing land use within ROW, but may not be consistent with Seattle Parks policies for ancillary structures if located in Lowman Beach Park. Pump stations is a "Utility Service Use" within the Shoreline District are only allowed outright only if it is considered a shoreline dependent use. Because this option involves acquisition of Single Family Residential properties, it is uncertain if this option will be considered compatible with existing land uses in the area.	2	Storage is most likely considered a "Utility Service Use". A Utility Service Use is allowed outright within the Shoreline District only if it can be demonstrated that it requires a shoreline location, although water-related uses (pump stations will likely be considered a water-related use) are preferred next in line to water-dependent uses within the Shoreline District.
4. Permitting Complexity	2	This alternative may require a Shoreline Permit for portions of the alternative within 200-ft of the shoreline. Only local permits required from SDOT (no federal or state permits required). Traffic impacts for local residents. Provisions for temporary and emergency access required.  SDOT Street Use permit fees could be extremely high because of size of facilities (pipe storage) and number of structures located within ROW (Costs accounted for in Cost Effectiveness Category).	2	This alternative will require a Shoreline Permit. Potential for marine access will add federal and state permits in addition to local permits. This could add up to a year or more to the schedule. Affected roadways have moderate traffic volumes in residential neighborhood with restricted access to residences south of Lowman Beach Park. Will require careful traffic planning to maintain access. Work hours likely to be restricted. Permit review likely to be complex.	2	This alternative may require a Shoreline Permit for portions of the alternative within 200-ft of the shoreline. Only local permits required from SDOT (no federal or state permits required). Traffic impacts for local residents. Provisions for temporary and emergency access required.  SDOT Street Use permit fees could be extremely high because of size of facilities (pipe storage) and number of structures located within ROW (Costs accounted for in Cost Effectiveness Category).
5. Property Acquisition Complexity	2	SDOT residential street, may require additional property for tunnel portal and ancillary facilities (odor control, electrical, generator, etc.). Acquisition is possible.	1	Property acquisition difficult if tank located on Seattle Public School Property and pump station located in park. Rating would change from 1 to 2 if tank and pump station are located on private property.	2	Single family residential properties must be acquired for rectangular tank. For pipe storage, SDOT (Residential Street), may require additional property for ancillary facilities (odor control, electrical, generator, etc.)



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CATEGORY / CRITERIA	ALTERNATIVE 1D: BOTTOM OF BASIN - TUNNELING		1E: UPPER BASIN STORAGE		1F: BOTTOM OF BASIN - COMBINED PIPE/RECTANGULAR STORAGE	
	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION
<b>ENVIRONMENT</b>						
1. Cultural Resources	2	No archaeological or historic resources identified in the project area. Based on site characteristics, the project area has a high probability of containing archaeological resources.	2	No archaeological resources identified in the project area. Based on site characteristics, the project area in which the pump station would be located has a high potential for containing archaeological resources. The majority of the rest of the basin has a low probability of containing archaeological resources. Historic properties in the upper basin include the Gatewood School (4320 SW Myrtle St.) and the Kenney Presbyterian Home for the Retired (7125 Fauntleroy Way).	2	No archaeological or historic resources identified in the project area. Based on site characteristics, the project area has a high probability of containing archaeological resources.
2. Fish and Wildlife	3	Construction and operation of this alternative would not affect fish and wildlife or their habitat.	3	Construction and operation of this alternative would not affect fish and wildlife or their habitat (assuming no clearing of forested areas was required). If marine access was required, rating would change from 3 to 1.	2	Construction would require clearing of forested area, which may affect fish and wildlife.
3. Wetlands, Streams, and Shoreline	2	It is assumed that Pelly Creek, which is piped through the project area, would likely have to be moved to construct this alternative. This alternative would not impact wetlands or shoreline areas.	3	Pelly Creek is piped through the project area along the northern edge of Lowman Beach Park. This rating assumes that construction would not impact the creek or any wetlands or shoreline area within the basin.	2	It is assumed that Pelly Creek, which is piped through the project area, would likely have to be moved to construct this alternative. This alternative would not impact wetlands or shoreline areas.
4. Soils and Sediments	3	No known contaminated sites. Project area is not within liquefaction zone and contains no steep slopes and/or potential or known landslide areas.	2	No known contaminated sites. Project area on west side of Beach Dr. SW is within liquefaction zone. No steep slopes and/or potential or known landslide areas on west side of Beach Dr. SW. Project area on the east side of Beach Dr. SW is not in liquefaction zone, but is adjacent to steep slopes and potential landslide area. Impacts on soils and sediments for storage in upper basin depends on location.	2	No known contaminated sites. Project area on west side of Beach Dr. SW is within liquefaction zone. No steep slopes and/or potential or known landslide areas on west side of Beach Dr. SW. Project area on the east side of Beach Dr. SW is not in liquefaction zone, but is adjacent to steep slopes and potential landslide area.
5. Water Quality	3	No new untreated discharges to surface waters.	3	No new untreated discharges to surface waters.	3	No new untreated discharges to surface waters.



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CATEGORY / CRITERIA	ALTERNATIVE 1D: BOTTOM OF BASIN - TUNNELING		1E: UPPER BASIN STORAGE		1F: BOTTOM OF BASIN - COMBINED PIPE/RECTANGULAR STORAGE	
	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION
<b>TECHNICAL</b>						
1. Technical Complexity	3	At bottom of basin and will capture peak flow using a weir in a diversion structure. Most reliable and will not require telemetry to divert flows.	2	Peak Pump Station Bottom of Basin, peak flows diverted by weir. But will require some telemetry to manage flow and volumes at storage facility. Considered more reliable since diversion is at bottom of the basin.	2	Bottom of Basin alternative, peak flows diverted by weir. But will require some telemetry to manage flow and volumes between two storage facilities. Considered more reliable since diversion is at bottom of the basin.
2. Compatibility with Existing WW system	2	May prolong peak event to existing system because stored flows will be fed back into the system after peak event passes. More pounds of BOD, TSS will be routed through treatment facilities.	2	May prolong peak event to existing system because stored flows will be fed back into the system after peak event passes. More pounds of BOD, TSS will be routed through treatment facilities.	2	May prolong peak event to existing system because stored flows will be fed back into the system after peak event passes. More pounds of BOD, TSS will be routed through treatment facilities.
3. Flexibility/Adaptive Management	2	Ability to expand in the R/W is limited because of space and ground surface restrictions. Ability to lengthen pipe limited because of steep excavation depths north and south of the placement area.	3	Area available within the parking of the Gatewood School.	3	Area available within parking lot of Fauntleroy School to expand tank or construct auxillary tank.
4. Constructability/Implementation Schedule	1	There may be construction difficulties with groundwater and excavation. Difficult construction conditions within street R/W; issues associated with ferry traffic.	2	There may be construction difficulties with groundwater, archaeological conditions, and excavation. Difficult construction conditions within street R/W; issues associated residential access during contruction.	3	No significant construction issues or risks beyond typical structure excavation and construction. Few, if any, traffic or access issues identified.



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CATEGORY / CRITERIA	ALTERNATIVE 1D: BOTTOM OF BASIN - TUNNELING		1E: UPPER BASIN STORAGE		1F: BOTTOM OF BASIN - COMBINED PIPE/RECTANGULAR STORAGE	
	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION
<b>O&amp;M</b>						
1. Staffing	3	Facility can be automatically started (gravity overflow) and run autonomously under design conditions. Minimal staffing required for operation and shut down. Some staffing/supervision may be needed for cleaning. Facility should not impact downstream facilities.	2	Facility can be automatically started and run autonomously under design conditions. However, facility will be started using monitoring and telemetry. This may require operator response to ensure proper startup and operation of the facility. Some staffing/supervision may be needed for cleaning. Facility should not impact downstream facilities.	3	Facility can be automatically started and run autonomously under design conditions. However, facility will be started using monitoring and telemetry. This may require operator response to ensure proper startup and operation of the facility. Some staffing/supervision may be needed for cleaning. Facility should not impact downstream facilities.
2. Training	3	Staff familiar with storage facilities and technology - Henderson & Mercer Street Tunnel. Similar control approaches to other facilities within the system can be specified for consistency.	3	Staff familiar with storage & pumping facilities and technology - Henderson & Mercer Street Tunnel. Similar control approaches to other facilities within the system can be specified for consistency.	3	Staff familiar with storage facilities and technology - North Creek & Henderson. Similar control approaches to other facilities within the system can be specified for consistency.
3. Reliability	3	System is not complex. Gravity diversion over a weir. Power not critical for ability to store peak flows. Storage is a proven technology for controlling peak flow events.	2	System requires telemetry/controls to effectively operate pump station and manage the storage of peak flows. Power is critical for operation of pump station, telemetry & monitoring equipment and ability to store peak flows. Storage is a proven technology for controlling peak flow events.	3	System is not complex. Gravity diversion over a weir. Power not critical for ability to store peak flows. Storage is a proven technology for controlling peak flow events. Telemetry and controls may be required to effectively manage storage volumes between rectangular tank and storage pipe.
4. Maintenance	2	Alternative requires less maintenance than other alternatives. Automatic flushing gates should provide most, if not all, the cleaning needed. Minimal telemetry/controls to maintain (typical level sensing and pump system controls). Assumes no entry.	2	Automatic flushing gates should provide most, if not all, the cleaning needed. More complex telemetry/controls than bottom of the basin alternatives (pump station monitors, possible flow meters, level sensing and pump system controls). Assumes no entry.	3	Alternative requires less maintenance than other alternatives. Automatic flushing gates should provide most, if not all, the cleaning needed. Minimal telemetry/controls to maintain (typical level sensing and pump system controls). Assumes no entry.
5. Safety	1	Street access required. Traffic control procedures required. Street use/closure permit required. Heavily travelled roadway. Rating would change from 1 to 2 if maintenance access can be moved outside of the travelled right-of-way.	3	No street access required. No traffic control procedures required. No street use/closure permit required.	1	Street access required. Traffic control procedures required. Street use/closure permit required. Heavily travelled roadway.



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	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION
<b>COST EFFECTIVENESS</b>						
1. Project Capital Costs	2	Relative cost = 1.7	1	Relative cost = 3.5	3	Relative cost = 1.2
2. Life Cycle Costs						
3. Cost Variability/Risk	3	Variability Ratio = 1.1	3	Variability Ratio = 1.2	3	Variability Ratio = 1.1
Note: Project Capital Costs for Murray Alternatives range from a low \$13M to a high of \$70M						
<b>COMMUNITY IMPACT</b>						
1. Location	1	Location of abovegrade structures will likely require residential property acquisition that may not be residential uses in future. Rating may depend on future uses of property.	1	Aboveground structure for large pump station in park, two pump stations in same location will impede land use in park. Below grade tank does not impose similar limitations on land use.	2	Below grade facility with limited abovegrade structures provides potential for future public access.
2. Potential Community Impacts	3	Infrequent, planned access by O&M staff reduces periodic impacts. Design considerations for abovegrade structures can reduce adverse impacts on community vision.	1	Pump station and tanks on separate sites will require additional maintenance attention. Design can reduce visual impacts. This would be a permanent change in how the land is used in this area and should be rated a 1.	3	Limited O&M frequency. Site use not likely to change community vision.
3. Construction Impacts	1	Large portal construction on Beach Dr. will require property acquisition and have impacts on traffic and emergency vehicle access. Long duration, high volume hauling would use narrow residential street adjacent to park.	1	Due to construction duration, multiple sites, temporary closure of park, and pipeline alignment along residential arterials for extended period, impacts will be significant.	2	Off street area available for construction staging. Construction can be sequenced to reduce impacts on traffic and neighborhood.



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CATEGORY / CRITERIA	ALTERNATIVE 2A: CONVEY & TREAT AT ALKI		ALTERNATIVE 3A - END OF PIPE TREATMENT, BOTTOM OF BASIN		ALTERNATIVE 5A: PEAK FLOW REDUCTION COMBINED W/STORAGE	
	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION
<b>LAND USE AND PERMITTING</b>						
1. City of Seattle Comprehensive Plan	1	Section 6.5 of the Seattle Comprehensive Plan (Utilities Element of the Planning Policies, U16) states that the City should work cooperatively with King County to identify and expeditiously address combined sewer overflows. Elsewhere in the Comp Plan (Land Use Element, Section 2.1, LU 61 & 62), uses in Single Family Residential neighborhoods should affirm and encourage residential use by one household as the principal use or should only encourage uses that are permitted outright. Alternative may not be fully consistent with Seattle Parks policies if peaking pump station is located in Lowman Beach Park. If the storage facility is not located in the park, the rating would be improved.	1	The large size of facility located within the Park and proximity to shoreline would most likely be contrary to Land Use policies LU 58, 61, & 62.	2	Section 6.5 of the Seattle Comprehensive Plan (Utilities Element of the Planning Policies, U16) states that the City should work cooperatively with King County to identify and expeditiously address combined sewer overflows. According to the Comp Plan (Land Use Element), uses in Single Family Residential neighborhoods should affirm and encourage residential use by one household as the principal use or should only encourage uses that are permitted outright. Storage is compatible with existing land use within ROW, but may not be fully consistent with Seattle Parks policies for ancillary structures if located in Lowman Beach Park.
2. Seattle Municipal Code (SMC/Zoning Code)	2	Zoning is Single Family Residential. Lowman Beach Park in potential placement area will require review for consistency with Parks policies. Dependent upon final location of pump station.	1	Zoning is Single Family Residential. New sewage treatment plants or expansion of existing are prohibited in SFR areas.	3	Utilities would be buried underground in the ROW which would only temporarily disrupt public access. Zoning: N/A (Located in ROW).
3. Shoreline Master Program Compatibility	1	Pump station is a "Utility Service Use". A Utility Service Use is allowed outright within the Shoreline District if it can be demonstrated that it requires a shoreline location. Because this option involves acquisition of Single Family Residential properties, it is uncertain if this option will be considered compatible with existing land uses in the area.	1	New treatment plants are not allowed in Shoreline District	3	Utilities would be buried underground in the ROW which would only temporarily disrupt public access. Parts of alternative may be in the Shoreline Zone.
4. Permitting Complexity	1	This alternative will require a Shoreline Permit. Potential for marine access will add federal and state permits in addition to local permits. This could add up to a year or more to the schedule. Affected roadways have high traffic volumes on a residential arterial with restricted access to residences. Will require careful traffic planning to maintain access. Work hours likely to be restricted. Permit review likely to be complex.	1	This alternative will require a Shoreline Permit. Potential for marine access will add federal and state permits in addition to local permits. This could add up to a year or more to the schedule. Affected roadways have low traffic volume in residential land uses. Will require careful traffic planning to maintain access. Work hours likely to be restricted. Permit review likely to be most complex. Treatment plant is an inconsistent use for single-family residential zone.	2	ROW permits required. Water quality treatment issues may increase permitting complexity. Affected roadways have moderate traffic volume in residential land uses. Will require careful traffic planning to maintain access. Work hours may be restricted. Permit review likely to be complex.
5. Property Acquisition Complexity	1	Location on park property for Murray pump station would be difficult. Rating would change from 1 to 2 if pump station located on private property.	1	Assumes location on park property. If located on private property rating would change to from 1 to 2. Neighborhood has expressed concerns, waterfront real estate. Acquisition possible for private property.	2	Street use permits, may require rights of entry for property disconnection. May require property acquisition for electrical, odor control, and/or stormwater treatment facilities.



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CATEGORY / CRITERIA	ALTERNATIVE 2A: CONVEY & TREAT AT ALKI		ALTERNATIVE 3A - END OF PIPE TREATMENT, BOTTOM OF BASIN		ALTERNATIVE 5A: PEAK FLOW REDUCTION COMBINED W/STORAGE	
	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION
<b>ENVIRONMENT</b>						
1. Cultural Resources	2	No archaeological or historic resources identified in the project area. Based on site characteristics, the project area in which the pump station would be located has a high probability of containing archaeological resources.	2	No archaeological or historic resources identified in the project area. Based on site characteristics, the project area has a high probability of containing archaeological resources.	2	No archaeological or historic resources identified in the pipe storage part of the project area. Based on site characteristics, this part of the project area has a high probability of containing archaeological resources. Disconnections in upper basin not expected to impact archaeological or historic resources.
2. Fish and Wildlife	3	Construction and operation of this alternative would not affect fish and wildlife, or their habitat. If marine access was required, rating would change from 3 to 1.	3	It is assumed that Pelly Creek is not a fish-bearing stream. Construction and operation of this alternative would not affect fish and wildlife, or their habitat. If marine access was required, rating would change from 3 to 1.	2	Construction of this alternative would not affect fish and wildlife, or their habitat. Operation could have adverse effects on fish and wildlife if treatment was not required for stormwater discharges.
3. Wetlands, Streams, and Shoreline	3	Pelly Creek is piped through the project area along the northern edge of Lowman Beach Park. This rating assumes that construction would not impact the creek or any wetlands or shoreline area within the basin.	2	It is assumed that Pelly Creek, which is piped through the project area along the northern edge of Lowman Beach Park, would likely have to be moved, and would be impacted by construction of this alternative. It is assumed that marine access would not be required. If marine access was required, construction would impact Puget Sound shoreline and rating would change from 2 to 1. No wetlands in the project area.	2	Pelly Creek, which is piped through the project area along the northern edge of Lowman Beach Park, would be impacted by construction of this alternative. This alternative would not impact wetlands.
4. Soils and Sediments	3	No known contaminated sites. Project area is within liquefaction zone. No steep slopes and/or potential or known landslide areas.	3	No known contaminated sites. Project area is within liquefaction zone. No steep slopes and/or potential or known landslide areas.	2	No known contaminated sites in the Beach Drive SW project area. This project area is not within liquefaction zone and contains no steep slopes and/or potential or known landslide areas. Soil and sediment impacts in upper basin depend on location of disconnections and stormwater system construction. Operation could impact sediment quality if treatment was not required for stormwater discharges.
5. Water Quality	3	No new untreated discharges to surface waters.	3	No new untreated discharges to surface waters.	1	It is assumed that stormwater treatment would not be required. If stormwater treatment was required, rating would change from 1 to 3.



Barton, Murray, Magnolia and North Beach CSO Projects  
Alternatives Analysis

MURRAY BASIN ALTERNATIVES

CATEGORY / CRITERIA	ALTERNATIVE 2A: CONVEY & TREAT AT ALKI		ALTERNATIVE 3A - END OF PIPE TREATMENT, BOTTOM OF BASIN		ALTERNATIVE 5A: PEAK FLOW REDUCTION COMBINED W/STORAGE	
	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION
<b>TECHNICAL</b>						
1. Technical Complexity	2	Bottom of Basin alternative, peak flows diverted by weir to peak flow pump station. But will require some telemetry and magement of an intermittently used pump station. Considered more reliable since diversion is at bottom of the basin.	1	Complex wastewater equipment and instrumentation	3	No wastewater equipment or telemetry.
2. Compatibility with Existing WW system	1	Will send the peak flow to existing downstream system as event occurs. May cause capacity issues at treatment plant. More pounds of BOD, TSS will be routed through treatment facilities.	3	Will not affect the operation of the existing treatment system.	3	Will not affect the operation of the existing treatment system.
3. Flexibility/Adaptive Management	2	Limited space available for expansion of peak flow pump station. Property is limited at the bottom of the basin and ability to expand in the future could be problematic.	2	Limited space available for expansion of HRC treatment facility. Property is limited at the bottom of the basin and ability to expand in the future could be problematic.	2	Additional separation could be undertaken if initial efforts do not provide control. However, identified cross-connected CSO sub-basin are not concentrated and limited within the Murray Basin.
4. Constructability/Implementation Schedule	2	No significant construction issues or risks beyond typical structure excavation and construction. Possible traffic and access issues regarding temporary construction conditions associated with Roxhill Playground.	2	There may be construction difficulties with groundwater and excavation. Limited construction access and issues associated with ferry traffic.	2	There may be construction difficulties with groundwater and excavation. Difficult construction conditions within street R/W; issues associated residential access during contruction.



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MURRAY BASIN ALTERNATIVES

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	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION
O&M						
1. Staffing	2	Facility can be automatically started and run autonomously under design conditions. However, facility will be started using monitoring and telemetry. This may require operator response to ensure proper startup and operation of the facility. Some staffing/supervision may be needed for cleaning. Facility should not impact downstream facilities.	1	Facility can be automatically started but will require operator response to ensure proper startup and operation. staffing/supervision may be needed for cleaning. Facility should not impact downstream facilities.	3	Routine staffing for stormwater system/treatment system maintenance.
2. Training	3	Staff familiar with pumping systems and technology. Similar operation and control approaches to other facilities within the system can be specified for consistency.	1	There are no other high-rate clarification treatment systems in the KC system. Staff un-familiar with Actiflo or packaged HRC system.	3	There are numerous stormwater conveyance and treatment facilities throughout the area.
3. Reliability	2	Requires operation of a pump station to convey peak flows. System will have standard reliability and redundancy measures incorporated into the design. Requires power, telemetry, and maintenance for reliable operation and function of the system.	2	System requires telemetry/controls to effectively store peak flows. Power is critical for operation of treatment facility, telemetry & monitoring equipment. Treatment technology is proven.	3	System is not complex. Gravity stormwater and treatment system. Peak flow reduction, when effectively implemented, is a proven technology for controlling peak flow events.
4. Maintenance	2	Alternative requires less maintenance than most other alternatives. More complex telemetry/controls than bottom of the basin alternatives (pump station monitors, possible flow meters, level sensing and pump system controls).	1	System will require the most maintenance of all alternatives. The treatment plant will have numerous systems (chemical, pumping, controls, disinfection, etc.) to maintain.	3	Minimal maintenance compared to other alternatives. Typical stormwater piping and treatment system maintenance.
5. Safety	3	No street access required. No traffic control procedures required. No street use/closure permit required.	3	No street access required. No traffic control procedures required. No street use/closure permit required.	2	Maintenance of storm sewers will require manhole access in streets.



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	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION	IMPACT RATING	DESCRIPTION
<b>COST EFFECTIVENESS</b>						
1. Project Capital Costs	1	Relative cost = 3.9	1	Relative cost = 5.3	2	Relative cost = 1.6
2. Life Cycle Costs						
3. Cost Variability/Risk	2	Variability Ratio = 1.8	3	Variability Ratio = 1.1	2	Variability Ratio = 2.0
Note: Project Capital Costs for Murray Alternatives range from a low \$13M to a high of \$70M						
<b>COMMUNITY IMPACT</b>						
1. Location	1	Large pump station in park will reduce size of park.	1	Changes land use.	3	No above grade facilities anticipated.
2. Potential Community Impacts	1	Long term duration of construction on Beach Dr. will impede traffic, access, and emergency vehicle access.	1	Significant O&M activities and storage of chemicals. Incompatible with land use.	2	Project will not increase the risk of flooding or slope instability. Traffic will be impacted due to access of facilities from roadway for maintenance.
3. Construction Impacts	1	Construction duration, access limitations, and traffic disruption as well as utilities relocations will adversely impact up to 400 residences, commuter traffic, emergency vehicle access. Construction controls used to reduce impacts will be difficult to implement.	2	Duration of construction, moderate hauling required with periodic deliveries of large equipment during construction. Temporary closure of park for construction staging.	1	Construction duration, access limitations, and traffic disruption as well as utilities relocations will adversely impact up to 30 residences along Beach Dr, commuter traffic, emergency vehicle access. Construction controls used to reduce impacts will be difficult to implement. Storm sewer construction will temporarily affect access for approximately 200 residences, however small diameter pipe only affects one side of right of way.