4.4 STORMWATER

This concept plan aims to improve stormwater quality and to reduce run-off volume by increasing the area of open space, soft landscaping and permeable surfaces. The integration of stormwater best management practices (BMP's) within the streetscape and open spaces will improve the stormwater management system.

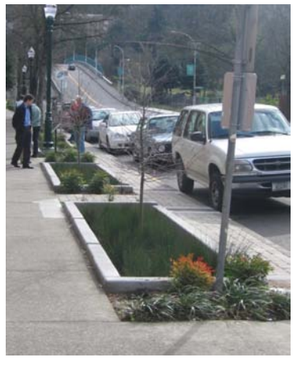
Natural BMP's that should be considered within the streetscape and open spaces include:

Raingardens within landscaped areas: shallow, depressed areas in the softscape, planted with vegetation that can withstand periodic inundation of water. Stormwater would be treated by filtration and infiltration processes.

Raingardens within streetscape areas: custom designed or proprietary biofiltration planters that are integrated into the streetscape. These would be landscaped elements designed to capture runoff from streets using openings in curbs, which treat stormwater by filtration and infiltration through the vegetation and an engineered soil medium.

Permeable paving: the use of permeable paving should be considered wherever feasible, e.g. within the parking areas and on sidewalks or lightly trafficked streets. Suitable types of permeable paving may include porous asphalt, porous concrete, pavers and reinforced grass. Future design teams should confirm the use of permeable paving within the streetscape with the Department of Public Works and the Mayor's Office of Disability.

Swales: small grass-lined or vegetated channels that direct stormwater into drainage areas along the ground surface. They can slow the velocity of surface run-off, and improve water quality via filtration and infiltration. These may be suitable within park and open space areas, but should be used with caution as they are not easily integrated into an urban streetscape environment.



Raingardens within streetscape

Swales within the landscaping

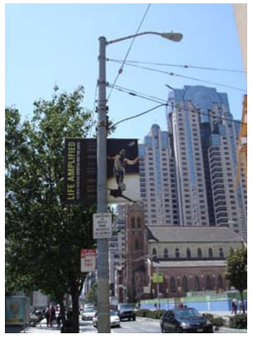
Formulation of a stormwater strategy is heavily impacted by maintenance issues and site conditions. Natural BMP's are most effective where subsoils are permeable and where groundwater is well below the surface. If in-situ soils are found to be impermeable, engineered drainage systems will be required within the BMP's to direct runoff to the City's stormwater system. Mechanical type BMP's such as media-filters and oil/water separators could be considered if the soils constrain natural infiltration techniques, but these devices require a dedicated maintenance plan. The San Francisco Public Utilities Commission (SFPUC) and the San Francisco Water Board should be consulted to determine a stormwater quality strategy that improves the quality of stormwater run-off without compromising the groundwater resource or imposing heavy maintenance demands. Stormwater BMP's can be effective in run off volume reduction. If these strategies are implemented on other redevelopment projects throughout the city they may be able to reduce operations and ease maintenance at the South East Water Pollution Control Plant (SEWPCP).

The feasibility of utilizing rainwater harvesting techniques in the redevelopment area should be considered in future design phases of the project. Run-off could be collected from hardscaped areas including Transbay Park, and adjacent building roofs and stored for landscape and open space irrigation purposes. This would reduce the volume of stormwater run-off entering the City's combined sewer system, and reduce the volume of potable water required for irrigation purposes. Treatment of this water may be required prior to irrigating. Storage and treatment facilities could be integrated into the streetscape, the parks and open spaces, or within redevelopment parcels.

4.5 IRRIGATION

The streetscape plans significantly increase the number of trees and area of open spaces in the neighborhood. Approximately 1100 trees are anticipated to be planted, which will require irrigation, especially during the initial establishment period. The need for permanent irrigation systems throughout the streetscape and within the new parks should be determined during the next phase of the project.

To reduce the volume of potable water used for irrigation, alternative water sources should be considered. Stormwater collected on site through rainwater harvesting, could be used for irrigation systems. As the design progress the feasibility of using groundwater wells as an alternative irrigation source should be investigated. Recycled water should also be considered as an alternative water supply source for irrigation. Although the City of San Francisco does not currently have a recycled water supply system in the area, future municipal recycled water supplies may become available. To facilitate the possible future use of recycled water for irrigation in the redevelopment area, the irrigation system should be constructed using code compliant purple pipe for recycled water, per Article 22: "Reclaimed Water Use", of San Francisco's Municipal Code. The system could use potable water or another irrigation alternative, until a recycled water supply becomes available.



Existing street light used for MUNI lines

4.6 STREET LIGHTS

The existing street lighting poles and fixtures will be replaced throughout the redevelopment area as described in Section 2.10. The impact of the new street fixtures on the existing power supply should be confirmed by future analysis, however it is unlikely that the energy demand of the new fixtures will require electrical capacity upgrades.

New light poles afford the opportunity to support overhead MUNI bus service lines. This would reduce the need for separate MUNI street poles, minimizing the number of poles within the pedestrian environment. Strengthened light poles with deeper foundations and thicker materials will be necessary to support these service lines. A pole, fixture and foundation detail should be developed during the future design phases of the project that meets the requirements of SFRA, MUNI, and the PUC.

4.7 STREETS

The plan on page 13, shows that most of the parcels to be redeveloped occur on Folsom, Main and Beale Streets. The program associated with these redevelopment parcels may significantly increase the utility demands. An assessment of the capacity of the existing utilities should be undertaken during future phases of the project to determine which existing utility lines need to be upgraded to adequately service future development.

For the purposes of this report, it is assumed that significant mainline utility upgrades will be required on Folsom, Main and Beale to service the new development. Under this scenario, these streets could be completely rebuilt during the utility upgrades. This would allow the streetscape improvements (new trees and curb realignments) to be effectively planned and integrated with the new utility infrastructure. A regular pattern of street trees should therefore be achievable if the streets are rebuilt completely. New utilities should be placed in the street where space permits, and should avoid layouts within the sidewalk where possible. New utility boxes, public cabinets, and vaults should be screened from the public's view on any point on the street where possible, while maintaining accessibility requirements.

The other streets within the redevelopment area have some adjacent new development, but a complete upgrade of the utility infrastructure may not be required. Under this scenario, the proposed street improvements could be retrofitted around the existing utility infrastructure, perhaps with limited utility relocations where financially viable. A detailed analysis of the existing constraints should be prepared for each of the streets where a retrofit approach is preferred. An accurate topographical survey of these streets should be performed to accurately determine the existing constraints, e.g. utilities, basements, curb cuts, and trees to be retained.

The existing utility information that has been studied as part of this preliminary analysis has been provided by SFRA and the utility providers, however the accuracy of the location of the utilities shown is unknown. It is likely that the drawings provided are not "as-built" information, and are therefore unsuitable for a detailed analysis of existing constraints. The locations of basements underneath existing sidewalks should also be confirmed during the next phase of the project as these may constrain tree planting.

The information provided is sufficient to identify potential future constraints for the redevelopment of each of the streets. The following sections discuss potential constraints identified during this preliminary analysis.