

## **RESTORATION BAY: PRELIMINARY DRAINAGE ANALYSIS**

The 95.9 acre Restoration Bay project site, a former golf course known as The Tides, is located in unincorporated Pinellas County near the City of Seminole (Section 33, Township 30 South, Range 15 East). 66<sup>th</sup> Avenue North forms the northern boundary of the site, which is bounded on the east by residential lots and Evergreen Avenue North, on the west by Pinellas County's Boca Ciega Millennium Park, and on the south by Boca Ciega Bay (a Pinellas County Aquatic Preserve). The site is within the Coastal Zone 5 drainage basin, sub-basin 28\_00\_15, per the Pinellas County Master Drainage Plan. The focus property lies within the Coastal High Hazard Area (CHHA) and flood zones X, AE, and VE as designated by FEMA on FEMA Flood Panel 12103C0108G dated September 3, 2003. Updated Preliminary FIRM maps have been completed by FEMA for this area which designate flood zones X (shaded and unshaded) and VE for the project site.

### **EXISTING CONDITIONS**

The Restoration Bay property generally slopes southward from the northern boundary along 66<sup>th</sup> Ave North to the southern terminus of the site at Boca Ciega Bay. Elevations range from 25-30 (NGVD) in the northeast corner down to approximately elevation 1.0 (NGVD) at the interface with Boca Ciega Bay. Topography is slightly undulating and sculpted, typical of a golf course, and drains southward towards the bay. One large existing pond is located on the northern edge of the property, near the former clubhouse, and a series of smaller ponds exist along the southern portion of the site. Onsite runoff is directed, either via the topography or through an onsite conveyance system consisting of ditches and pipes/culverts, to the southern ponds. These ponds provide minimal water quality benefits, as they served to attenuate runoff to be used for onsite irrigation of the golf course.

As is the case throughout much of Pinellas County, which has nearly reached its build-out capacity, the residential area surrounding Restoration Bay was developed before stormwater and environmental regulations were put in place. Untreated stormwater runoff from a substantial portion of this surrounding area currently flows onto and/or through the site, via the northern and eastern boundaries, before discharging to Boca Ciega Bay.

- The northern onsite pond, adjacent to the former club house, receives untreated stormwater runoff from approximately 64.05 acres of offsite drainage area. The pond discharges to a ditch behind the residential lots on the south side of 66<sup>th</sup> Ave North, which itself receives untreated stormwater runoff from an additional 11.6 acres of offsite area. The ditch then flows westward to the property boundary and onto and through the County's Millennium Park before reaching Boca Ciega Bay. The nutrient and pollutant loads transported to Boca Ciega Bay through this system is further exacerbated by the degraded state of the conveyance ditch. It is apparent that County staff are unable to access the ditch (located behind private residences) with the proper equipment to perform maintenance, as the ditch is overgrown and suffering from extended erosive patterns due

to high flows. The ditch banks are sloughing off and this sediment material is then conveyed downstream as well.

- The eastern site boundary receives runoff from approximately 104 acres of offsite drainage area from three separate piped outfalls. This runoff is predominantly untreated, although small portions are first routed through small localized ponds before mingling with the remaining flows and discharging to the site. The two northern outfalls are piped onsite and discharge to surface conveyance features (ditches) which meander through the golf course before discharging to one of the existing southern onsite ponds. The third and southernmost discharge on the eastern boundary is conveyed via underground pipe to an onsite concrete sump before discharging to Boca Ciega Bay. It has been noted that high velocities and sediment/trash transport are an issue with this conveyance, and that the current configuration of the sump hinders the County's access and successful maintenance. A remnant swale also exists along the eastern boundary of the property which appears to have been intended to capture the runoff from the rear yards of the adjacent residential lots. Stormwater now ponds/stages in the rear yards and flows between the houses as the swale has largely filled with accumulated sediment over time.

In total, untreated runoff from ±180 acres of offsite urbanized/developed area flows into/through the site. Further analysis and basin delineation may indicate that runoff from additional offsite areas may flow to and/or through the property. Untreated stormwater runoff from urban development, especially runoff which does not receive appreciable water quality treatment, is known to accelerate eutrophication in receiving surface waters – this is evidenced by the condition of the onsite ponds and the water bodies within the County's adjacent Millennium Park. The lack of treatment for onsite runoff further contributes to the pollutant and nutrient loads leaving the property. The high velocities of the offsite flows, coupled with the flow volumes, transport considerable sediment and particulate pollutants and promote erosion of the surface conveyances, which further contributes to the sediment loading. The current drainage configuration of onsite and offsite flows conveys sediment and nutrient loading either directly or indirectly (through Millennium Park) to Boca Ciega Bay, a Pinellas County Aquatic Preserve.

## **PROPOSED CONDITIONS**

To paraphrase the Pinellas County Stormwater Manual, *'each redevelopment project provides an opportunity to incrementally contribute to the County's goals of addressing stormwater infrastructure needs, reducing pollutant loadings, restoring impaired waters, and enhancing wetlands and wildlife habitats (sic)'*. Restoration Bay, as the name suggests, presents an ideal set of circumstances to help the County achieve progress towards each of these goals. Surrounded by, and receiving untreated stormwater runoff from, built-out residential areas on two sides, the site conveys flow west to the County's Millennium Park and south to Boca Ciega Bay (a Pinellas County Aquatic Preserve). Although the former golf course is currently not in use as such, the sloping and undulating topography affords additional opportunities for creative and innovative approaches relative to site layout and aesthetics. Design efforts will emphasize a holistic stormwater management and site planning approach which evaluates all of the proverbial tools in the Best Management Practices (BMP) toolbox along with Green Infrastructure (GI) and Low Impact Development (LID) techniques and practices. The resulting design elements will

maximize the water quality treatment/benefits achieved, mimic natural process, be integrated with the landscape, and be both aesthetically pleasing and highly functional.

### Offsite Flows

Untreated stormwater runoff from ±180 acres of surrounding built-out residential area is conveyed to/through the site to Boca Ciega Bay. Providing water quality treatment for this runoff is paramount, as the project site is the most “downstream” location in the drainage basin with redevelopment potential (the remainder is either residential neighborhood or the County’s Millennium Park), and this runoff conveys nutrients/pollutants/sediments directly to the Aquatic Preserve. The treatment train approach will be used to maximize the benefits of the systems and elements selected to address both the north-side and east-side offsite flows. It is not possible for this project to treat the offsite runoff at or near to its source, which would be ideal, so the optimal solution is to begin the treatment train at the locations where this runoff enters the site.

Offsite flows from the area north of the site, as previously described, flow to and through the northern pond adjacent to the former clubhouse and the conveyance ditch located along the northern property boundary. The following treatment train is currently under consideration:

- Hydrodynamic separators and/or baffle boxes installed on the incoming pipe discharges to slow velocities and trap/filter out particulates, trash, debris, and sediments. These elements would be situated to be accessible for proper maintenance.
- A linear east-west wet detention pond running parallel with the northern project boundary. This proposed wet detention pond would incorporate multiple design features to enhance both functionality and aesthetics. Ideally, the east and west “ends” of the pond would be deep pools to maximize residence time, while the center “connecting” segment would be a shallow littoral zone with appropriate plantings to maximize nutrient uptake prior to discharge. In addition to accepting the discharge from the hydrodynamic separators/baffle boxes, the pond itself would replace the existing conveyance ditch and serve to attenuate, treat, and convey flow to the west via an outfall structure. The pond shape and banks would undulate on the southern (downhill) side, similar to the current golf course topography, to follow existing contours and provide visual relief. Siting constraints at this location may dictate that this BMP be split into two hydraulically-connected elements. The inflow/outflow control elevations of this pond will be carefully configured to maintain or lower the current hydraulic grade line (HGL) of the respective upstream systems to prevent adverse offsite impacts (flooding/back-up upstream).
- A raingarden or bioswale behind the offsite northern private residences in the current approximate location of the conveyance ditch. This element would capture and provide treatment for runoff from the rear yards (and any overland flow conveyed from the street) before discharging into the wet pond. Plantings in the rain garden or bioswale would be a marked improvement from the current eroded ditch, creating an attractive façade with the undulating pond immediately behind.
- An up-filter system will be considered for the pond outfall, which could drastically increase the nutrient removal capacity of the system. The pond outfall would slow/control discharge west to Millennium Park under normal operating conditions and provide high-capacity outflow for larger storm events.

Offsite flows from the area east of the site enter the site via three separate discharge pipes. Two of these discharges are then conveyed, via surface conveyance ditches, through the site before discharging into one of the southern ponds and subsequently to Boca Ciega Bay. The third discharge is conveyed via underground pipe to a concrete sump before discharging to Boca Ciega Bay. The following treatment train is currently under consideration:

- Hydrodynamic separators installed on the northern incoming pipe discharges (currently discharge to onsite conveyance ditches) to slow velocities and trap/filter out particulates, trash, debris, and sediments. These elements would be situated to be accessible for proper maintenance.
- Large-volume baffle box installed on the southern incoming pipe discharge (currently conveyed via underground pipe) to slow velocities and trap/filter out particulates, trash, debris, and sediments. A baffle-box type solution is likely appropriate for this discharge due to the noted high velocities and high-volume of debris. This element would also be situated to be accessible for proper maintenance.
- Three stepped/cascading wet detention ponds – one to accept flow from each of the incoming pipes. Ponds configured as a smaller/shorter version of the pond proposed for the northern boundary, with deep pools at either end and a shallow littoral zone in the middle to maximize both residence time and nutrient uptake. The inflow/outflow control elevations of these ponds will be carefully configured to maintain or lower the current hydraulic grade line (HGL) of the respective upstream systems to prevent adverse offsite impacts (flooding/back-up upstream).
- An up-filter system will be considered for each pond outfall, which could significantly increase the nutrient removal capacity of the system.
- Pond outfalls designed to take advantage of the sloping topography with cascading outfalls to a created conveyance feature. These “cascades” would be visually interesting and fun as well as provide aeration/oxygenation to the discharged water and promote sediment deposition and pollutant removal.
- Created surface conveyance to accept pond discharges. Designed to safely accept and convey the discharge from the ponds during all storm events, this created conveyance may also be planted and made to meander/wander through the site in a manner reminiscent of a natural stream. If siting and topographic constraints allow, cascade features may also be incorporated into the conveyance feature along with shallow pool areas to hold/slow water during normal conditions, create additional diverse environments and provide additional water quality polishing and sediment deposition.
- Rain gardens and/or bioswales may be incorporated into the eastern-most edge of the property, behind the existing residences, to replace the rear-yard swale and provide treatment, limited attenuation, and conveyance to the surface conveyance feature (or directly to the ponds as topography and configuration details dictate). Plantings in the rain gardens/bioswales would provide visual appeal as well as water quality treatment.

- Sump and/or stormwater harvesting pond at downstream end of created conveyance feature prior to discharge to Boca Ciega Bay. Ideally the conveyance feature would discharge to a stormwater harvesting pond, which would further reduce velocities, increase residence time in the system, and allow sediment deposition. Removal of runoff from the system for irrigation will be a preferred option (thus removing any pollutant/nutrient loads in the water reused from Boca Ciega Bay loading). At a minimum a sediment sump, which could be designed to resemble a deep pool in the “stream,” would be incorporated.

The proposed treatment trains, integrated into the landscape along the edges of the site, will provide much-needed treatment for the offsite flows resulting in a myriad of benefits for the water quality of Boca Ciega Bay, the aesthetic appeal of the site, and current and future residents and visitors. The proposed elements will slow velocities, remove sediments and solids (trash, debris, particulates, etc.), moderate the temperature of water discharged, and significantly reduce the nutrient and pollutant loading to the Aquatic Preserve. Further water quality benefits can be realized by harvesting the stormwater to offset irrigation needs. The proposed BMPs also address the necessary maintenance requirements for successful and long-lived functionality. Full quantification of the water quality benefits (estimates of sediment, nutrients, and pollutants removed, degree to which peak flows are reduced, etc.) will be dependent on siting constraints and final configuration, but will greatly exceed the “net improvement” standard and may approach the demanding parameters associated with the Aquatic Preserve, which enjoys the same protections afforded to Outstanding Florida Waters (OFW).

### Proposed Onsite Flows

The stormwater management approach for the proposed portion of the project will employ the same holistic approach, but with the added benefit of being able to incorporate site planning aspects as well as treating runoff as close as possible to its source. Stormwater quality treatment will be provided as required per OFW standards, but actual treatment provided may exceed these requirements depending on BMP selection and configuration. For the northern/upper portion of Restoration Bay, the following elements are under consideration:

- Pervious/porous pavement sidewalks and driveway sections to “break-up” and reduce Directly Connected Impervious Areas (DCIA). Strategic placement will reduce overall runoff volumes and allow smaller localized BMPs to provide water quality treatment and limited attenuation.
- Curb-cuts to reduce the volume and velocity of stormwater runoff from streets and direct it to smaller localized BMPs to provide water quality treatment and limited attenuation.
- Pervious/porous pavement or cellular paving system for parking areas, maintenance roads, and/or special limited-use access points.
- Small “local” BMPs to provide initial treatment and limited attenuation for discrete drainage areas. These may include rain gardens and/or bioswales (including potential median

placement), interceptor trees, hydrodynamic separators, and specialized soil media depending on application and placement. These “local” BMPs would serve the dual role of stormwater treatment/attenuation while also serving to meet landscaping requirements and provide aesthetic value.

- One or more deep-pool wet detention ponds designed to maximize residence time and nutrient uptake. Potential inclusion of “fountain” amenity would also serve to aerate/oxygenate the water and provide mixing of the water column within the pond. Up-flow filters will be considered for the outfall(s).
- In lieu of the above, the topography and siting conditions may be conducive to a more localized approach. Multiple small, linear wet detention ponds or rain gardens/bioswales designed to treat runoff from small, discrete drainage areas (e.g. one for each block) before discharging to the central conveyance feature (either piped or surface) from the northern portion of the site.
- Discharge from the pond(s) would be conveyed to the southern portion of the project either by underground piping or, preferably, by a created surface conveyance similar to that proposed for the eastern offsite flows. The created surface feature would be designed to safely convey flows from all storm events, receive flow from additional BMPs as it traverses the site, and to take advantage of the sloping topography by including small shallow pools immediately upstream of cascade features to hold/slow water during normal conditions, create additional diverse environments and provide additional water quality polishing and sediment deposition. Whether piped or conveyed via a surface conveyance feature, runoff from the upper portion of the site would be directed to a sump/stormwater harvesting pond (ideally the same sump/stormwater harvesting pond that the eastern offsite flows are conveyed to) before discharging to Boca Ciega Bay.

The following elements are under consideration for the southern portion of Restoration Bay:

- One or more deep-pool wet detention ponds designed to maximize residence time and nutrient uptake. Potential inclusion of “fountain” amenity would also serve to aerate/oxygenate the water and provide mixing of the water column within the pond. Up-flow filters will be considered for the outfall(s).
- In lieu of the above, the topography and siting conditions may be conducive to a more localized approach. Multiple small, linear wet detention ponds or rain gardens/bioswales designed to treat runoff from small, discrete drainage areas (e.g. one for each block) before discharging to the central conveyance feature (either piped or surface) from the northern portion of the site.
- The local BMPs, pervious/porous pavement sidewalks, and curb cut strategies detailed for the northern portion of the site will be utilized in the southern portion as well.
- Hydraulically connected linear BMPs will be implemented along the edges of the property to prevent stormwater runoff from discharging, untreated, directly to Boca Ciega Bay. This

may include a series of rain gardens, swales, or bioswales which discharge to the internal stormwater management system (where possible).

- Stormwater harvesting pond/sump at the downstream confluence of the stormwater conveyance system prior to discharge to Boca Ciega Bay. Ideally, the entire onsite stormwater system and the flows conveyed from the eastern offsite system would be directed to a single stormwater harvesting pond. Designed to also function as a sediment sump and allow equipment access for maintenance, considerable quantities could be used from this pond for site irrigation demands. Actual usage/removal amounts (and thus nutrient/pollutant removal efficiencies and quantities) will be dependent on final configuration and analysis. At a minimum, a properly-sized and designed sediment sump will be incorporated at the downstream end of the onsite stormwater system.

## SUMMARY

The project site is bordered on two sides by residential/urban areas that were developed prior to stormwater and environmental regulations. Untreated stormwater runoff from these areas mixes with onsite runoff and is conveyed either directly to Boca Ciega Bay, or indirectly to the bay via the County's Millennium Park. Existing onsite ponds, designed to attenuate stormwater for golf course irrigation, provide no measurable water quality benefits. Existing stormwater infrastructure on and immediately adjacent to the site suffers from erosion, lack of required maintenance, and lack of water quality measures. The site is no longer maintained or in-use as a golf course, which serves to amplify and exacerbate issues related to erosion and maintenance. Untreated runoff, laden with nutrients/pollutants from the ±180 acres of offsite residential area, is discharged to the site at high/erosive velocities. This offsite runoff combines with untreated onsite runoff in the various conveyances and ponds before entering Boca Ciega Bay, a Pinellas County Aquatic Preserve.

The proposed Restoration Bay project is located at the downstream end of its drainage basin in the midst of a built-out environment devoid of substantive water quality treatment. Discharging directly to Boca Ciega Bay, and adjacent to the County's Millennium Park, the site presents a unique opportunity to showcase the potential benefits that redevelopment projects can provide. Restoration Bay will utilize a stormwater management/site planning approach consistent with the County's, and will serve as a benchmark for future projects. GI, LID, and conventional stormwater BMPs and techniques/practices will be implemented throughout all aspects of the project design to facilitate a functional, integrated, aesthetically appealing system. Offsite flows will be separated from onsite flows throughout their respective treatment trains until discharge. The proposed BMP treatment trains and associated GI/LID practices will meet or exceed OFW water quality requirements for onsite runoff and will greatly exceed the "net improvement" goal (and may approach OFW requirements) for the offsite flows entering the site.

The stormwater management system envisioned for Restoration Bay will reduce velocities, remove nutrients/pollutants/sediments, incorporate a wide variety of conventional and non-conventional BMPs, and provide crucial water quality treatment for discharges to Boca Ciega Bay. Beyond the water quality benefits to be achieved, the proposed systems will also serve as amenities as they will create varied and diverse habitats for wildlife, support attractive and

functional plantings, utilize the existing topography to maintain and enhance the current undulating terrain, and provide opportunities for public education/recreation/interaction. Restoration Bay will further the County's stated goals for redevelopment projects of reducing pollutant loadings (BMP treatment trains for onsite and offsite flows), play a role in the restoration of impaired water bodies (Boca Ciega Bay), addressing stormwater infrastructure needs (replacing existing inadequate conveyance for offsite flows), and enhancing wetland and wildlife habitats (creation of varied habitats, resultant improvement to water bodies in Millennium Park by treatment of northern offsite flows). Restoration Bay will do its part to restore Boca Ciega Bay, and should be viewed as a "win" for the environment, the community, the County, and the Aquatic Preserve.