





- All dollar amounts are in 2010 dollars.
- Beach access is considered **unlimited** if it is walkable more than 90% of the year. This is measured by how often the daily maximum total water level (TWL) impacts the toe of the feature backing the beach (dune or BPS).
- •Beach nourishment occurs for all dune restoration projects (DRP) that require it, and for 20% of BPS projects that require nourishment. • Currently BPS and DRP are only placed on the outer coast in front of developments, • During beach nourishment projects, beaches are widened at 5x the yearly shoreline change retreat rate. This is based on the assumption but we may want to implement dune restoration to restore/maintain habitat that the nourished sediment will last for approximately 5 years before needing to be replenished. in future simulations.



Take Home Messages:

scenario.

under a **high** impact climate scenario by policy

- Currently there is limited beach accessibility across the county, although there is only BPS in one location in Ocean Shores.
- Over time, there continues to be relatively high beach accessibility in Ocean Shores under all policy scenarios (Figure 3).
- Beach accessibility is limited in Westport, although accessibility varies across policy scenarios, especially Protect and Restore (Figure 4).
- Different policies affect beach access differently, with the most accessibility under the Protect and the Restore policy scenarios, since they are both nourishing the beach in front of backshore protection structures (BPS) and dune restoration projects (DRP).
- Beach accessibility is similar under the Baseline and Realign policy scenarios, since neither policy nourishes the beach.
- Beach accessibility decreases by 2100 in all scenarios as sea level rises and only some areas of the beach are nourished.
- Under different policy scenarios, different areas of the beach begin to lose accessibility at different times (Figure 4), depending where and when the beach is nourished.

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to cost $$13/m^3$.

climate scenario for all policy scenarios in both Ocean Shores (top panels) and Westport (bottom panels).

How much money will it cost to keep the beach accessible? Annual and Cumulative Cost of County-Wide Beach **Nourishment Under High Impact Climate Scenario** Annual nourishment costs are much lower than cumulative costs - Cumulative Restore - Cumulative Protect under the **Protect** and - Annual Restore **Restore** policy Annual Protect scenarios Figure 5: The annual and cumulative cost of beach scenarios in a high climate scenario. Under Protect, beaches are nourished in front of DRP. Year



How should habitat be protected/conserved under the **Restore** Policy Scenario?

- Mudflats
 - Eelgrass
- restore, and what policies to put into place
 - Build dune to protect outer coast habitat?

 - Remove buildings in designated areas?

Take Home Messages:

- The cost of beach nourishment under the **Restore** policy scenario is **higher** than under the **Protect** policy scenario because all projects that need nourishment are being nourished under Restore, while only 20% of projects that need nourishment are receiving it under **Protect** (Figure 5).
- Under the Protect and Restore policy scenarios, beach nourishment only occurs in front of BPS or DRP. • Currently there is **no** beach nourishment in the **Baseline** or **Realign** policy scenarios.
- The annual cost of beach nourishment varies (Figure 5) due to a combination of the assumption of when to nourish (every 5 years if needed) and storminess. The cumulative cost varies by ~ \$25 million between **low** and **high** impact climate scenarios by 2100.
- Currently **no** habitat restoration or conservation policies are in place under the **Restore** policy scenario.

•Beach nourishment occurs under the Protect policy scenario, in front of BPS, and in the Restore scenario in front of dunes and is assumed

- for 50 years

• Currently no habitat or specific areas of undeveloped land are being protect or restored

•The following habitats were mentioned as priorities in prior workshops and webinars:

•We need your help in determining what specific areas to protect/

- Nourish beaches to protect habitat?
- Limit/halt development in designated areas?



nourishment county-wide, under the Restore and Protect beaches are nourished in front of BPS, and under **Restore**,



• Nourishment projects fronting BPS are triggered under a set of specific instances:

- The dune toe is impacted by the maximum daily Total Water Level (TWL) >50% of the year on average for 50 years
- Nourishment projects fronting DRP are triggered under a specific set of instances:
 - The dune toe is impacted by the maximum daily Total Water Level (TWL) >50% of the year on average

• Event erosion erodes through the dune width for 3 out of the last 5 years.



Figures 6 and 7: The length of road in Grays Harbor County impacted by erosion under all policy scenarios under a low (left) and high (right) impact climate scenario from 2010-2100.



Annual Length of Road Impacted by Flooding on Outer Coast



Figures 8 and 9: The length of road in Grays Harbor County impacted by annual flooding under all policy scenarios under a low (above) and high (below) impact climate scenario from 2010-2100.

Take Home Messages:

- Erosion impacts to roads is higher under the Baseline and Realign policies than the **Protect** and the **Restore** policy scenarios (Figures 6-7).
- The length of roads impacted by erosion increases over time, particularly midway through the century (Figures 6-7).
- Flooding impacts to roads varies under the Baseline, Realign, Protect and **Restore** policy scenarios (Figures 8-9), and are highest under **Baseline** which has no hazard alleviation policies.
- County-wide flooding has a much larger impact on roads than erosion, now and into the future (Figures 6-9).
- Currently, these coastal hazard impacts only includes roads on the outer coast.