San Rafael Canal District Parcel Analysis

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Overview

This script runs analyses of parcels in the Canal District that will experience varying inundation with 12 inches or 1 foot of sea-level rise.

```
#Read in Canal District Parcels inundated with 12" SLR
canalparcels_SLR12 <- read_csv(here("data", "Canal_District_Parcels2023_Final.csv"))
```

```
## Rows: 931 Columns: 35
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr (12): Parcel, Prop_ID, Prop_ID_1, Deed_ReferenceID, Owner_Name, Tax_Rate...
## dbl (20): OID_, OBJECTID, SHAPE_Leng, SHAPE_Area, Parcel_1, FREQUENCY, MAX_g...
## num  (3): Land_Area_SqFt, Living_Area_SqFt, DeckPatio_SqFt
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
canalparcels_SLR12
```

```
## # A tibble: 931 x 35
##     OID_ OBJECTID Parcel   Prop_ID    SHAPE_Leng SHAPE_Area Parcel_1 Prop_ID_1
##    <dbl>    <dbl> <chr>    <chr>           <dbl>      <dbl>    <dbl> <chr>
##  1    78  2371553 01745001 017-450-01       110.       703.  1745001 017-450-01
##  2   308  2371790 01744002 017-440-02       133.       751.  1744002 017-440-02
##  3   314  2371796 00807206 008-072-06       672.     28052.   807206 008-072-06
##  4   323  2371805 01415229 014-152-29      3067.    338808.  1415229 014-152-29
##  5   332  2371814 00809112 008-091-12       476.     13865.   809112 008-091-12
##  6   341  2371823 01418106 014-181-06       251.      3375.  1418106 014-181-06
##  7   443  2371929 00932040 009-320-40      3060.    468955.   932040 009-320-40
##  8   446  2371932 00913237 009-132-37      1166.     81725.   913237 009-132-37
##  9  1961  2373503 01743009 017-430-09       119.       654.  1743009 017-430-09
## 10  1970  2373512 00922122 009-221-22       110.       703.   922122 009-221-22
## # i 921 more rows
## # i 27 more variables: FREQUENCY <dbl>, MAX_gridcode <dbl>,
## #   Deed_ReferenceID <chr>, Owner_Name <chr>, Tax_Rate_Area <chr>,
## #   Assessment_City <chr>, Land_Assessed_Value_TY2023 <dbl>,
## #   Improvements_Assessed_Value_TY2 <dbl>,
## #   Business_Assessed_Value_TY2023 <dbl>, Personal_Assessed_Value_TY2023 <dbl>,
## #   Total_Assessed_Value_TY2023 <dbl>, Use_Code <dbl>, ...
```

```
sapply(canalparcels_SLR12, class)
```

```
##                          OID_                     OBJECTID
##                     "numeric"                    "numeric"
```

```
##                         Parcel                       Prop_ID
##                    "character"                   "character"
##                     SHAPE_Leng                    SHAPE_Area
##                      "numeric"                     "numeric"
##                       Parcel_1                     Prop_ID_1
##                      "numeric"                   "character"
##                     FREQUENCY                  MAX_gridcode
##                      "numeric"                     "numeric"
##               Deed_ReferenceID                    Owner_Name
##                    "character"                   "character"
##                  Tax_Rate_Area                Assessment_City
##                    "character"                   "character"
##     Land_Assessed_Value_TY2023 Improvements_Assessed_Value_TY2
##                      "numeric"                     "numeric"
##  Business_Assessed_Value_TY2023  Personal_Assessed_Value_TY2023
##                      "numeric"                     "numeric"
##    Total_Assessed_Value_TY2023                      Use_Code
##                      "numeric"                     "numeric"
##           Use_Code_Description                      Use_Type
##                    "character"                   "character"
##             Improvement_Status                  Living_Units
##                    "character"                     "numeric"
##              Construction_Year             Construction_Years
##                    "character"                   "character"
##                 Land_Area_SqFt               Living_Area_SqFt
##                      "numeric"                     "numeric"
##                       Bedrooms                      Bathrooms
##                      "numeric"                     "numeric"
##                    Garage_SqFt                 DeckPatio_SqFt
##                      "numeric"                     "numeric"
##                      Pool_SqFt                Unfinished_SqFt
##                      "numeric"                     "numeric"
##                     ObjectID_1
##                      "numeric"
```

```r
#Tidy dataframe
canalparcels_SLR12<-canalparcels_SLR12 %>%
  select(Parcel, Prop_ID, MAX_gridcode, Deed_ReferenceID, Owner_Name, Tax_Rate_Area, Assessment_City,
         Land_Assessed_Value_TY2023, Improvements_Assessed_Value_TY2, Business_Assessed_Value_TY2023,
         Personal_Assessed_Value_TY2023, Total_Assessed_Value_TY2023, Use_Code, Use_Code_Description,
         Use_Type, Improvement_Status, Living_Units, Construction_Year, Construction_Years, Land_Area_Sq
         Living_Area_SqFt, Bedrooms, Bathrooms, Garage_SqFt, DeckPatio_SqFt, Pool_SqFt, Unfinished_SqFt)
canalparcels_SLR12<- canalparcels_SLR12 %>%
  filter(!Parcel %in% c("00809307", "00809306", "00916119"))
canalparcels_SLR12[is.na(canalparcels_SLR12)] = 0

#Exclude non-Canal parcels
canalparcels_SLR12<- canalparcels_SLR12 %>%
  filter(!MAX_gridcode %in% c(4,5))

#Convert grid code classes to flood depth intervals (in)
canalparcels_SLR12 <- mutate(canalparcels_SLR12, Flooding_Depth_in = case_when(MAX_gridcode == 1 ~ '0 -
                                                                               ,MAX_gridcode == 2 ~ '2.74 - 5.48
                                                                               ,MAX_gridcode == 3 ~ '5.48 - 8.22
```

```
#Read in Overtopped Parcels
overtopping_parcels_canaldist <- read_csv(here("data", "Overtopping_Parcels_CanalDist.csv"))
```

```
## Rows: 497 Columns: 55
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr (23): Class, Fortified, Frontage, Bayshore_Defense, Agency_Designation, ...
## dbl (24): OID_, Join_Count, TARGET_FID, JOIN_FID, OT_ft, OBJECTID_1, SHAPE_L...
## num  (3): Land_Area_SqFt, Living_Area_SqFt, DeckPatio_SqFt
## lgl  (5): Transportation_Type, Agency_Designation_Source, FEMA_Accreditation...
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
overtopping_parcels_canaldist <- overtopping_parcels_canaldist %>%
  distinct(Prop_ID, FREQUENCY, MAX_gridcode, Overtopped)
overtopping_parcels_canaldist <- overtopping_parcels_canaldist %>%
  filter(Overtopped == "Overtopped") %>%
  select(c(Prop_ID, Overtopped))
```

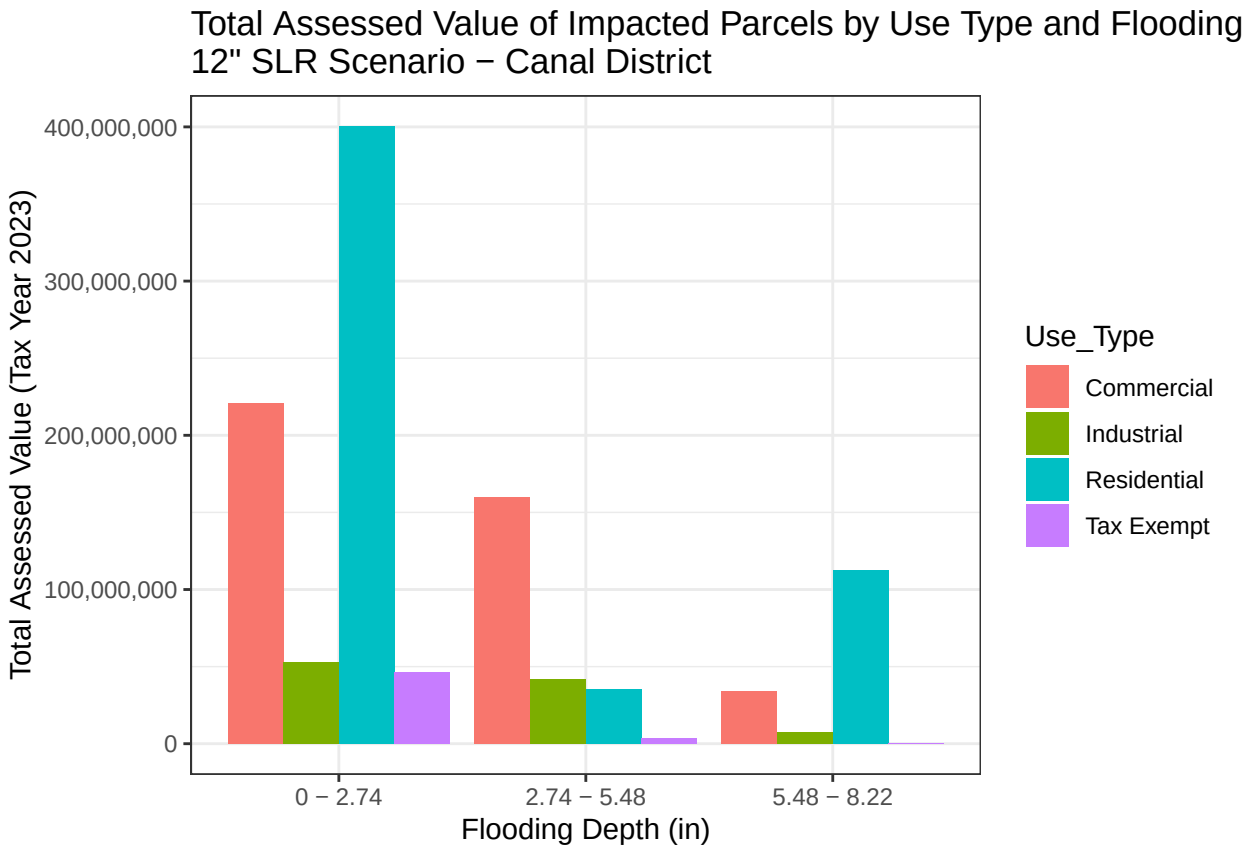
Summary Plots

The following plots provide summary information about parcels impacted in the Canal District with 12" SLR

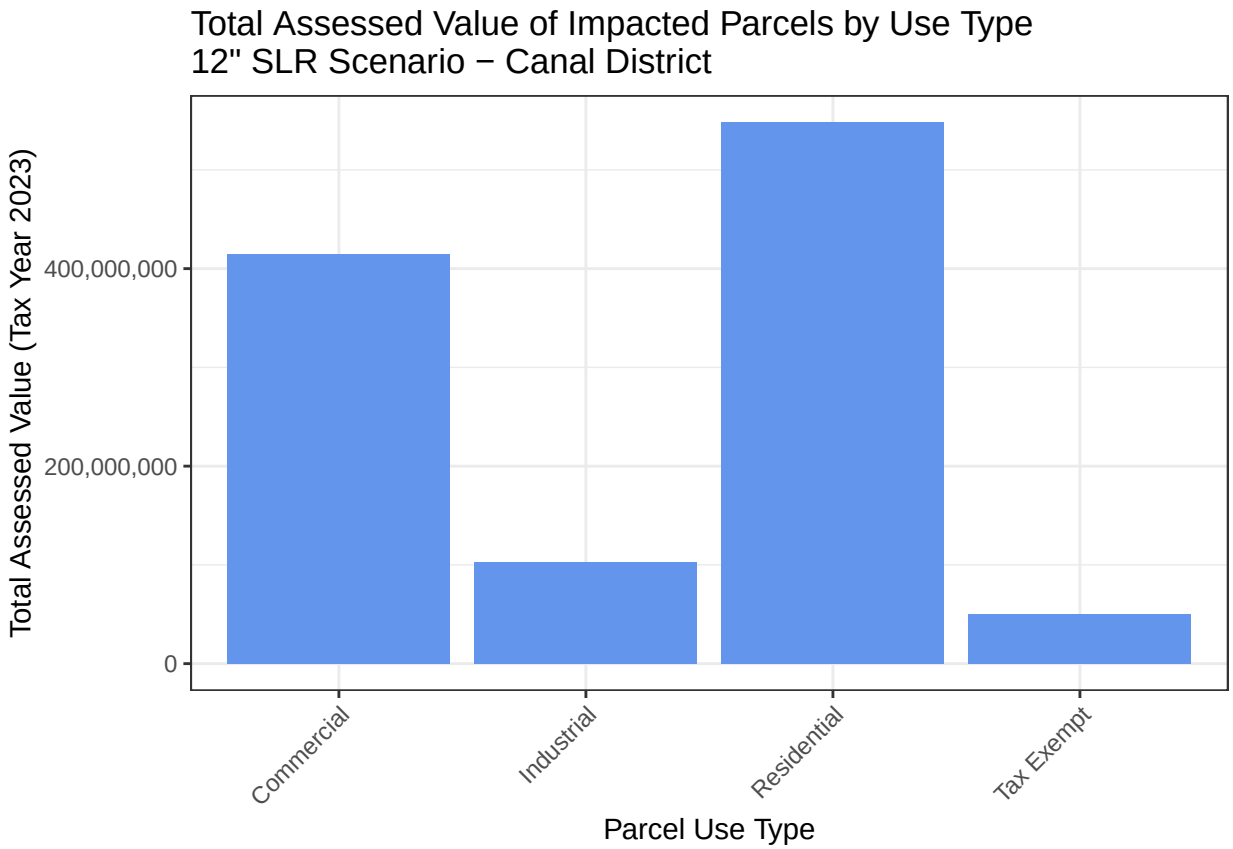
```
#Summary: Impacted parcels by flooding depth, use type, and total assessed value
summary_canalparcels_SLR12_flooddepth <- canalparcels_SLR12 %>%
  group_by(Flooding_Depth_in, Use_Type)%>%
  summarise(Total_Assessed_Value_sum = sum(Total_Assessed_Value_TY2023)) %>%
  ungroup()
```

```
## `summarise()` has grouped output by 'Flooding_Depth_in'. You can override using
## the `.groups` argument.
```

```
summary_canalparcels_SLR12_flooddepth <- summary_canalparcels_SLR12_flooddepth %>%
  filter(!Use_Type == "Common Area")

ggplot(summary_canalparcels_SLR12_flooddepth, aes(x= Flooding_Depth_in, y= Total_Assessed_Value_sum,
                                          fill= Use_Type))+
  geom_bar(stat= "identity", position=position_dodge())+
  xlab("Flooding Depth (in)")+
  ylab("Total Assessed Value (Tax Year 2023)")+ # Set axis labels
  ggtitle('Total Assessed Value of Impacted Parcels by Use Type and Flooding Depth (in)
12" SLR Scenario - Canal District')+
  theme_bw()+
  scale_y_continuous(labels = label_comma())
```

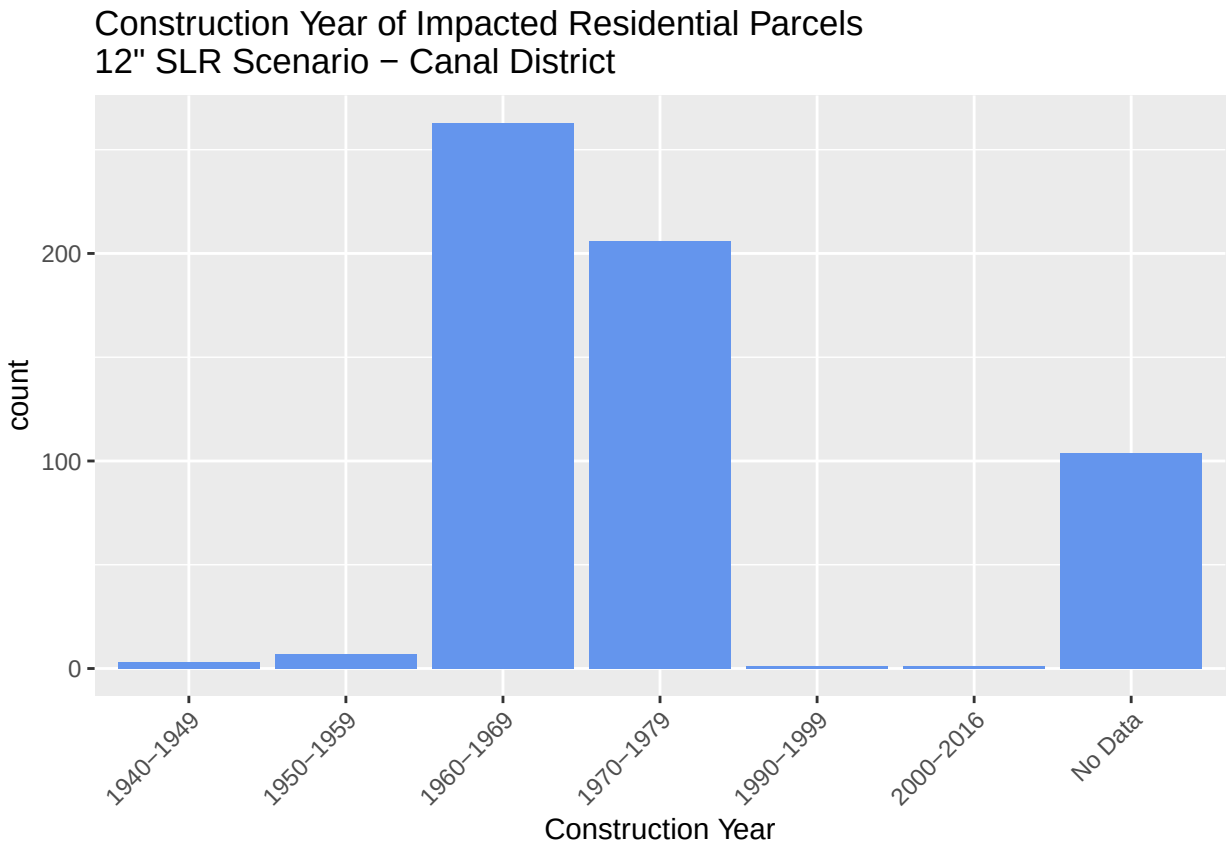



```
#Summary: Total assessed value (tax year 2023) by parcel use type
summary_canalparceltypes_value <- canalparcels_SLR12 %>%
  group_by(Use_Type)%>%
  summarise(Total_Assessed_Value_sum = sum(Total_Assessed_Value_TY2023)) %>%
  ungroup()

summary_canalparceltypes_value <- summary_canalparceltypes_value %>%
  filter(!Use_Type == "Common Area")

ggplot(summary_canalparceltypes_value, aes(x= Use_Type, y= Total_Assessed_Value_sum))+
  geom_bar(stat= "identity", position=position_dodge(), fill="cornflowerblue")+
  xlab("Parcel Use Type")+
  ylab("Total Assessed Value (Tax Year 2023)")+ # Set axis labels
  ggtitle('Total Assessed Value of Impacted Parcels by Use Type
12" SLR Scenario - Canal District')+
  theme_bw()+
  scale_y_continuous(labels = label_comma())+
  theme(axis.text.x = element_text(angle=45, vjust=1, hjust=1))
```




```
#Summary: Impacted residential parcels
canalparcels_SLR12_residential <- canalparcels_SLR12 %>%
  filter(Use_Type == "Residential")

ggplot(canalparcels_SLR12_residential, aes(x=Construction_Years))+
  geom_histogram(stat="count", fill = "cornflowerblue")+
  ggtitle('Construction Year of Impacted Residential Parcels
12" SLR Scenario - Canal District')+
  xlab("Construction Year")+
    theme(axis.text.x = element_text(angle=45, vjust=1, hjust=1))
```

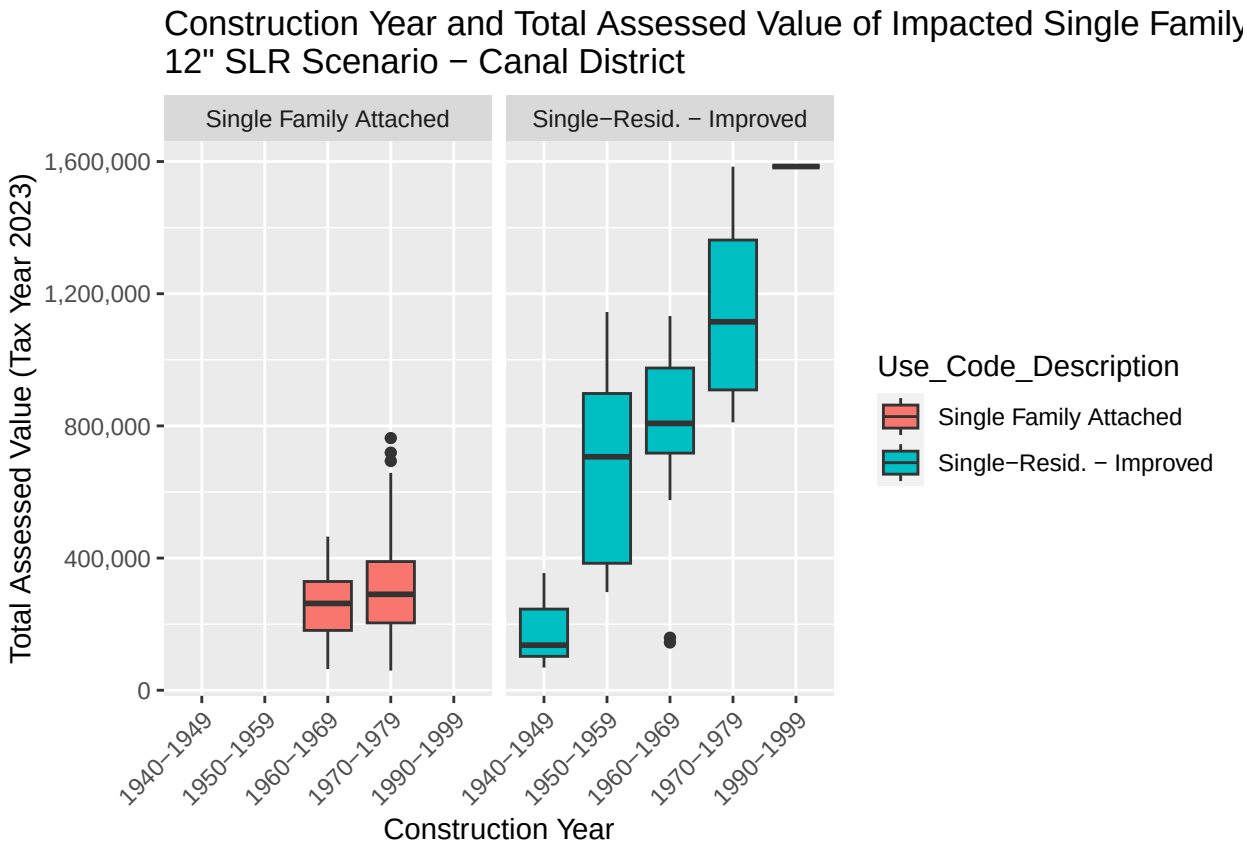
```
## Warning in geom_histogram(stat = "count", fill = "cornflowerblue"): Ignoring
## unknown parameters: `binwidth`, `bins`, and `pad`
```




```
table(canalparcels_SLR12_residential$Construction_Years)
```

```
##
## 1940-1949 1950-1959 1960-1969 1970-1979 1990-1999 2000-2016   No Data
##         3         7       263       206         1         1       104
```

```
#Summary: Impacted residential parcels by Construction Year (where data was available)
canalparcels_SLR12_residential_year <- canalparcels_SLR12_residential %>%
  filter(!Construction_Year == "No Data")

canalparcels_SLR12_residential_year <- canalparcels_SLR12_residential_year %>%
  filter(!Use_Code_Description == "Multiple-Resid. - Improved")

ggplot(canalparcels_SLR12_residential_year, aes(Construction_Years, Total_Assessed_Value_TY2023, fill=Us
  geom_boxplot()+
  scale_y_continuous(labels = label_comma())+
  theme(axis.text.x = element_text(angle=45, vjust=1, hjust=1))+
  facet_wrap(~Use_Code_Description)+
  xlab("Construction Year")+
  ylab("Total Assessed Value (Tax Year 2023)")+ # Set axis labels
  ggtitle('Construction Year and Total Assessed Value of Impacted Single Family/Residential Parcels
12" SLR Scenario - Canal District')
```



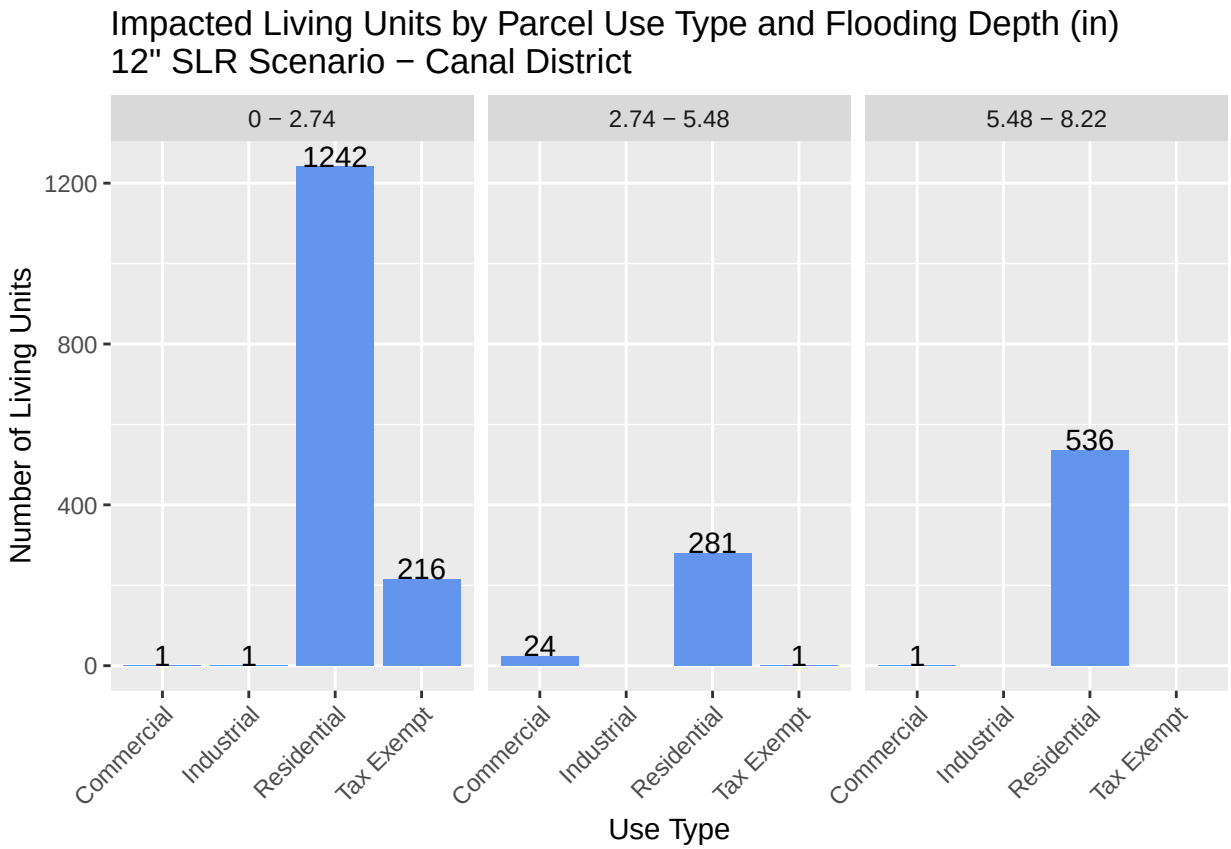

```
#Summary: Impacted parcels with living units
living_units_canal_flooddepth <- canalparcels_SLR12 %>%
  filter(Living_Units>0) %>%
  group_by(Flooding_Depth_in, Use_Type)%>%
  summarise(count = sum(Living_Units)) %>%
  ungroup()
```

```
## `summarise()` has grouped output by 'Flooding_Depth_in'. You can override using
## the `.groups` argument.
```

```
sum(living_units_canal_flooddepth$count)
```

```
## [1] 2303
```

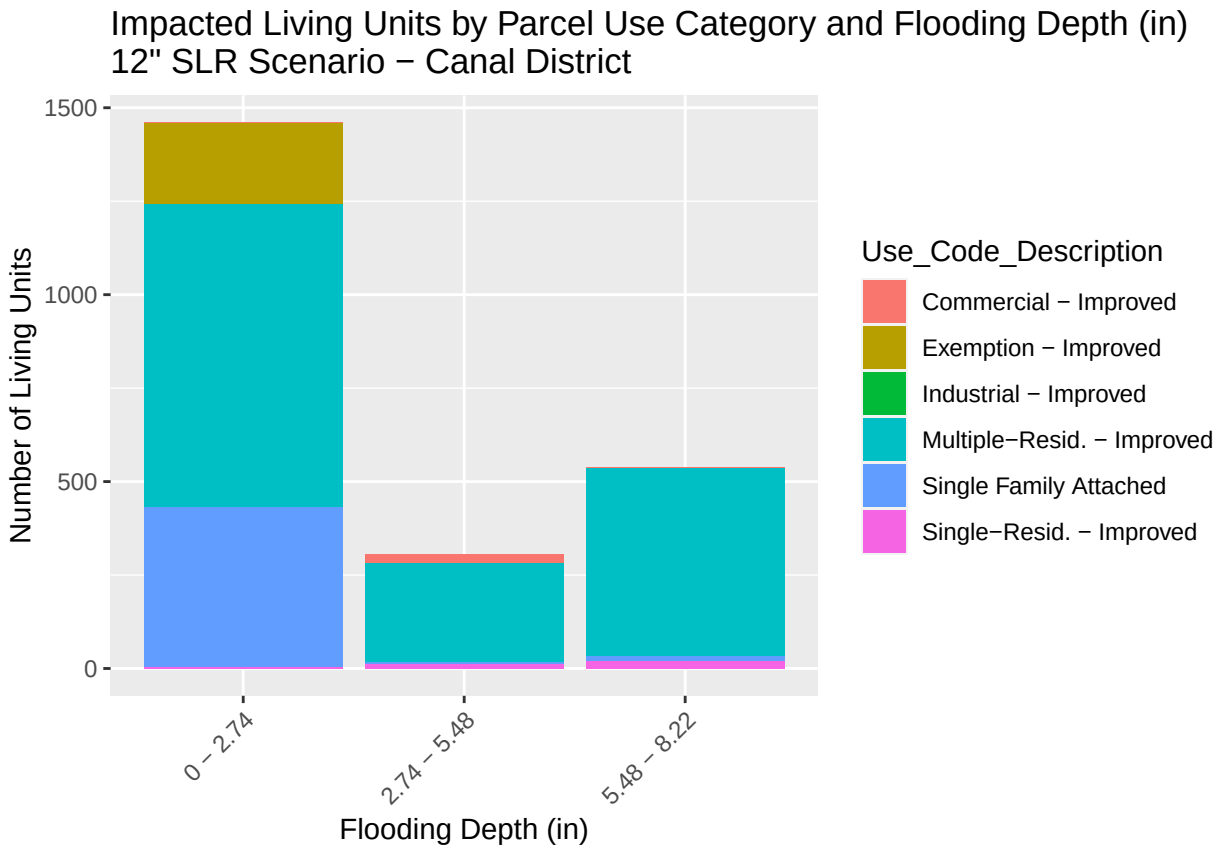
```
ggplot(living_units_canal_flooddepth, aes(x= Use_Type, y= count))+
  geom_bar(stat= "identity", position=position_dodge(), fill = "cornflowerblue")+
  xlab("Use Type")+
  ylab("Number of Living Units")+ # Set axis labels
  ggtitle('Impacted Living Units by Parcel Use Type and Flooding Depth (in)
12" SLR Scenario - Canal District')+
  theme(axis.text.x = element_text(angle=45, vjust=1, hjust=1))+
  geom_text(aes(label = count), vjust=.01)+
  facet_wrap(~Flooding_Depth_in)# Set title
```




```
#Summary: Impacted parcels with living unites by use code
living_units_canal_use_code <- canalparcels_SLR12 %>%
  filter(Living_Units>0) %>%
  group_by(Flooding_Depth_in, Use_Code_Description)%>%
  summarise(count = sum(Living_Units)) %>%
  ungroup()
```

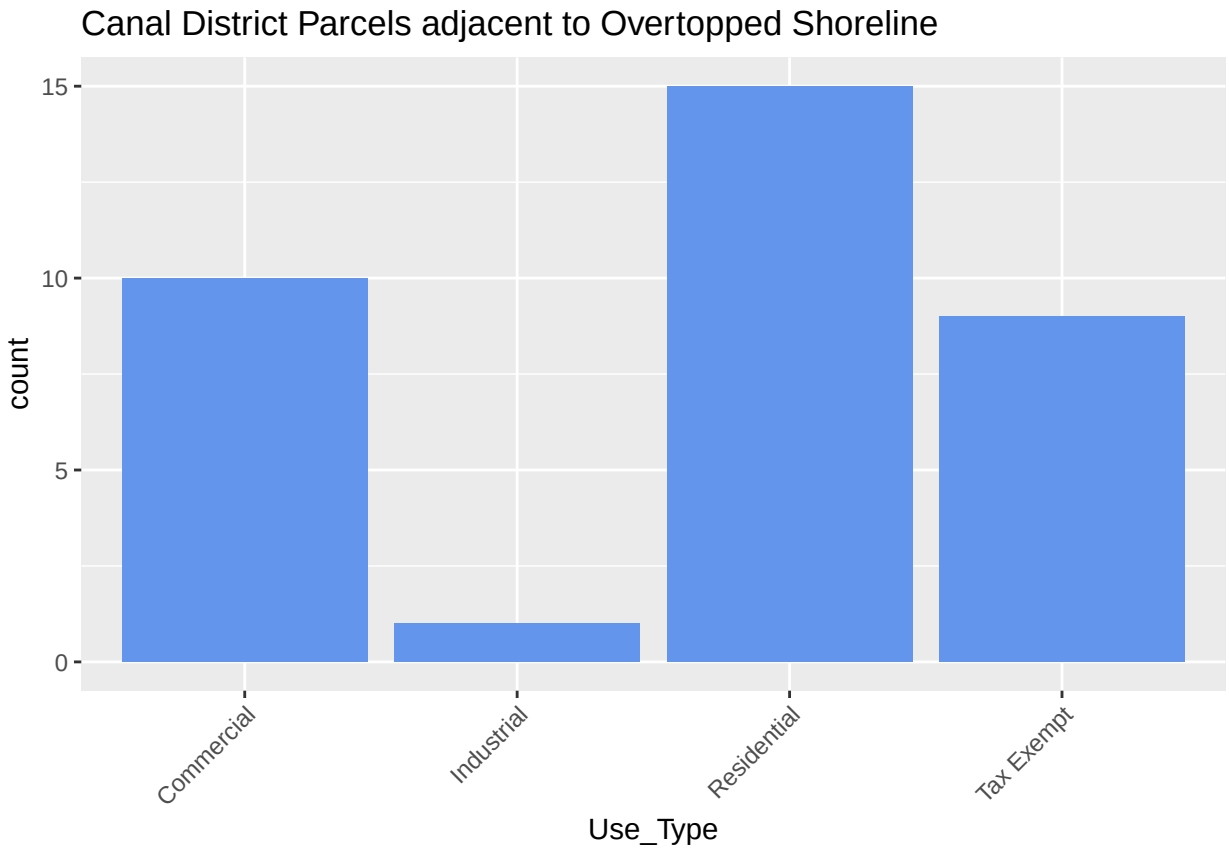
```
## `summarise()` has grouped output by 'Flooding_Depth_in'. You can override using
## the `.groups` argument.
```

```
ggplot(living_units_canal_use_code, aes(x= Flooding_Depth_in, y= count, fill = Use_Code_Description))+
  geom_bar(stat= "identity")+
  xlab("Flooding Depth (in)")+
  ylab("Number of Living Units")+ # Set axis labels
  ggtitle('Impacted Living Units by Parcel Use Category and Flooding Depth (in)
12" SLR Scenario - Canal District')+
  theme(axis.text.x = element_text(angle=45, vjust=1, hjust=1))
```




```
#Join canal parcel data with with overtopping data
canalparcels_SLR12_overtopping <- canalparcels_SLR12 %>%
  left_join(overtopping_parcels_canaldist, by= "Prop_ID")

#Summary: Canal parcels with overtopping
canalparcels_SLR12_overtopping<- canalparcels_SLR12_overtopping %>%
  filter(Overtopped == "Overtopped")

ggplot(canalparcels_SLR12_overtopping, aes(x=Use_Type))+
  geom_histogram(stat="count", fill = "cornflowerblue")+
  ggtitle("Canal District Parcels adjacent to Overtopped Shoreline")+
  theme(axis.text.x = element_text(angle=45, vjust=1, hjust=1))
```

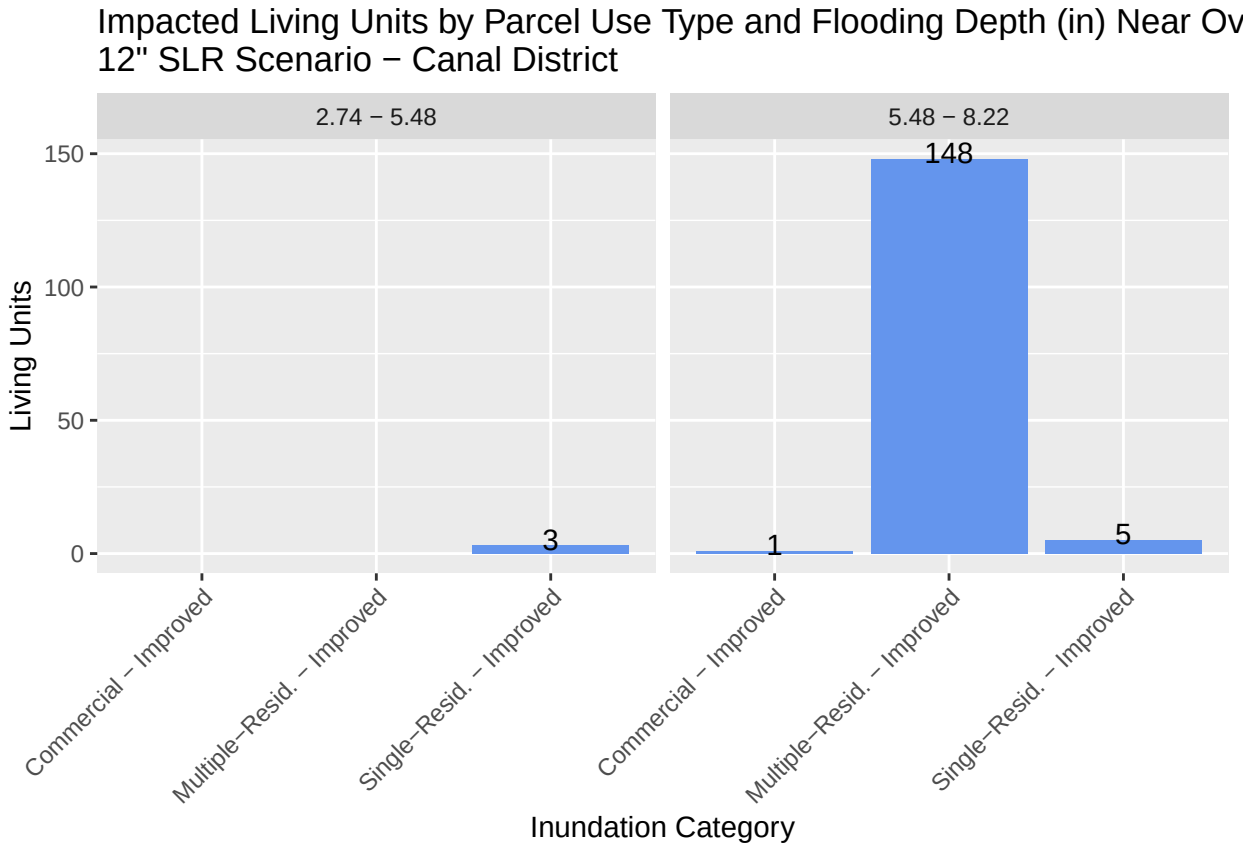
```
## Warning in geom_histogram(stat = "count", fill = "cornflowerblue"): Ignoring
## unknown parameters: `binwidth`, `bins`, and `pad`
```




```
#Summary: Canal parcels with living units AND overtopping
living_units_canalparcels_SLR12_overtopping <- canalparcels_SLR12_overtopping %>%
  filter(Living_Units>0) %>%
  group_by(Flooding_Depth_in, Use_Code_Description)%>%
  summarise(count = sum(Living_Units)) %>%
  ungroup()
```

```
## `summarise()` has grouped output by 'Flooding_Depth_in'. You can override using
## the `.groups` argument.
```

```
ggplot(living_units_canalparcels_SLR12_overtopping, aes(x= Use_Code_Description, y= count))+
  geom_bar(stat= "identity", position=position_dodge(), fill = "cornflowerblue")+
  xlab("Inundation Category")+
  ylab("Living Units")+ # Set axis labels
  ggtitle('Impacted Living Units by Parcel Use Type and Flooding Depth (in) Near Overtopping Points
12" SLR Scenario - Canal District')+
  theme(axis.text.x = element_text(angle=45, vjust=1, hjust=1))+
  geom_text(aes(label = count), vjust=.2)+
  facet_wrap(~Flooding_Depth_in)# Set title```
```


Impacted Living Units by Parcel Use Type and Flooding Depth (in) Near Ov
12" SLR Scenario − Canal District
2.74 − 5.48
5.48 − 8.22
Living Units
150
100
50
0
3
1
148
5
Commercial − Improved
Multiple−Resid. − Improved
Single−Resid. − Improved
Commercial − Improved
Multiple−Resid. − Improved
Single−Resid. − Improved
Inundation Category