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## SECTION 18 - EARTHWORK

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### **18-1 GENERAL**

Earthwork shall conform to Section 19, "Earthwork", of the State Specifications, and these Specifications. All references to the "roadway prism", "roadway facilities", "roadway", and "highway" shall be considered to mean the applicable project features, shown on the Plans or referenced in the Special Provisions.

The method and rate of applying water for earthwork and dust control shall conform to Section 16, "Water Used in Construction", and Section 17, "Dust Control", of these Specifications.

Attention is directed to Section 10, "Environmental Controls at Work Site", of these Specifications for additional requirements.

### **18-2 ROADWAY EXCAVATION**

#### **18-2.01 General**

Roadway excavation shall conform to Section 19-2, "Roadway Excavation", of the State Specifications, and these Specifications.

Roadway excavation shall include removal of existing pavement sections, ditches and channels in the median area, between roadway and frontage roads and side ditches contiguous to the roadway and other locations as shown on the Plans. Excavation and embankment side slopes shall be adjusted by the Contractor to clear existing utility poles, vegetation, and other improvements, as directed by the City.

Roadway excavation shall also include excavation of waterway channels as necessary to create a grading plane for the placement of slope protection.

#### **18-2.02 Unsuitable Roadway Excavation and Backfill**

Any unsuitable material encountered shall be removed and backfilled in accordance with Section 18-5, "Unsuitable Material Excavation", in this Section of these Specifications.

#### **18-2.03 Surplus Material**

Unless otherwise specified in the Special Provisions, surplus excavated material shall become the property of the Contractor and shall be disposed of away from the project site in accordance with the provisions in Section 18-7, "Surplus Material Disposal", in this Section of these Specifications.

#### **18-2.04 Unsuitable Material in Embankments**

Unsuitable material excavated as roadway excavation which, in the opinion of the City, can be used for roadway embankment shall be placed in the embankment below a plane thirty inches (30") below the finished grade and compacted to a minimum relative compaction of ninety three percent (93%).

Unsuitable material excavated as roadway excavation which, in the opinion of the City, cannot be worked into the roadway embankment shall be considered as surplus material and removed from the work site or wasted within the right-of-way as directed by the City.

**18-2.05 Subgrade Preparation`**

Subgrade preparation shall be as specified in Section 19-5, "Compaction" and Section 19-6, "Embankment Construction", of the State Specifications. Organics that exist within the roadway prism prior to grading shall be stripped from the ground surface. Stripping should extend to between two inches (2") to three inches (3") below the existing surface or as directed by the City. Strippings are the property of the Contractor and shall be removed from the job site. After removal of strippings, areas to receive fill material or new structural sections shall be scarified to a depth of at least twelve inches (12") and recompacted to a relative compaction of not less than ninety-three percent (93%).

Relative compaction of not less than ninety-five percent (95%) shall be obtained for a minimum depth of one foot (1') below the subgrade grading plane for the width between the outer edges of shoulders, whether in excavation, embankment, or at original ground level. All other material shall be compacted to a relative compaction of ninety three percent (93%), excluding subgrade under meandering sidewalks that is not adjacent to curb and gutter. Embankment under bridge and retaining wall footings shall be compacted as specified in Section 19-5.03B, "Relative Compaction (95 Percent)", of the State Specifications.

When the next layer of material to be placed on the subgrade is an asphalt concrete pavement, asphalt concrete base, or asphalt concrete subbase, the subgrade grading plane at any point shall not vary more than three-hundredths of a foot (0.03') above or below the grade established by the City. All subgrade or base shall be verified by string line or GPS by the inspector.

Subgrade or aggregate base shall be stable prior to paving. The City requires the Contractor to proof roll the area prior to placing asphaltic concrete. Proof rolling shall be performed by a fully loaded 4,000 gallon water truck.

For roadway construction, material encountered at the subgrade grading plane, as shown on the Plans, that the City determines unacceptable for roadway foundation shall be removed. Should the depth of removal of unacceptable material be less than twelve inches (12"), the area shall be filled with roadway excavation material, if available, or as approved by the City. Should no roadway excavation material be available, the area of unacceptable material removal less than twelve inches (12") in depth shall be filled with Class 2 aggregate base. Should the depth of unsuitable material encountered within the roadway prism extend to a depth of more than twelve inches (12") below the grading plane as shown on the Plans, removal of unsuitable material shall extend to twelve inches (12") below said grading plane. The area from which the unacceptable material has been removed shall then be compacted to a relative compaction of ninety-three percent (93%) as determined by the City. Fill for areas of unsuitable material removed to a depth of twelve inches (12") below the grading plane for roadway construction shown on the Plans shall consist of placement of geotextile fabric as specified in Section 18-5.03, "Geotextile Material", in this Section of these Specifications and backfilled with Class 2 aggregate base.

For roadway construction, if there are insufficient quantities of native material to make subgrade, recycled asphalt concrete or aggregate base from project removals may be used. Removed asphalt concrete shall be processed to three-inch (3") maximum size and thoroughly mixed with local native material and placed in the lower lifts of roadway fills as necessary to achieve subgrade. The City may order removal of soft and unstable material

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below the grading plane and backfill with acceptable import materials if the subgrade (grading plane) is unsuitable to place the next layer of the structural section.

### **18-2.05A Subgrade Soils – Roadway, Curb and Gutter, and Sidewalks**

Subgrade soils shall be stable and unyielding, compacted as specified, and graded as designed. All work shall comply with Section 19 of the Caltrans Standard Specifications unless addressed by these specifications.

#### 1. Subgrade Preparation

All subgrade shall be scarified to a depth of twelve inches (12”) and moisture conditioned to between 0 and 3 percent above optimum moisture content as determined by ASTM D3017. If the roadway was undercut by more than twelve inches (12”) during mass grading to account for trench spoils scarification will not be necessary. However, all material placed within the undercut shall be compacted to at least ninety-three (93%) percent of the ASTM D1557 maximum dry density and moisture conditioned to between 0 and 3 percent above optimum moisture content.

#### 2. Compaction

Prepared subgrade soils shall be compacted to at least 95 percent of the ASTM D1557 maximum dry density and moisture conditioned to between 0 and 3 percent above optimum moisture content. Testing shall conform to ASTM D2922 and D2017 for nuclear density testing. Nuclear density tests shall be performed at intervals no greater than 150 linear feet for each of the following, sidewalk, curb and gutter, and roadway. A minimum of 3 density tests shall be performed on each cul-de-sac. Density tests shall also be performed at all curb returns. All tests shall be plotted on the plan views of the record drawings. The moisture content shall be maintained until the placement of AB. If the moisture content is not maintained then steps 1 and 2 shall repeated prior to placement of AB.

#### 3. Subgrade Stability

The finished subgrade shall be proof rolled prior to aggregate base placement to evaluate the load/deflection characteristics of the finished subgrade materials. Proof rolling shall be performed by a fully loaded 4,000 gallon water truck. Proof rolling shall be performed in each lane of the roadway. If the tested surface shows a visible deflection at the time of loading or a visible crack remains after loading, corrective measures shall be implemented. Corrective measures shall be determined on a case-by-case basis. All corrective measures shall be documented and located on the record drawings.

#### 4. Finished Subgrade

Finished subgrade shall be compacted in accordance with the Geotechnical Engineer’s soils report for the project, with all tests achieving ninety-five percent (95%) of the ASTM D1557 maximum dry density. Finished subgrade will be tested at a frequency of (1) test per 150 linear feet of roadway. Tests should be located so an even distribution is made across the cross section. For roadways with median islands, the subgrade will be treated as that section between lip of gutter and face of median curb for each side. Where a median exists, each side of the roadway shall be

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considered as an individual length of road for the purpose of this testing. Sidewalk, curb and gutter sections shall be tested at a frequency of one (1) test per 150 linear feet and be independent of the testing in the roadway section.

### **18-2.06 Measurement and Payment**

Measurement and payment for roadway excavation will be as set forth in Section 19-2.04, "Payment", of the State Specifications, except that the Contract price paid per cubic yard for roadway excavation will include full compensation for compacting natural and original ground, for subgrade preparation, for all haul and overhaul, for excavation, for placing earth embankment as shown on the Plans and as directed by the City, and for furnishing all water necessary for the compaction of the material and subgrade preparation. The Contract price paid also includes shaping and trimming slopes to solid material and to the lines and elevations shown on the Plans.

The removal of material within the areas of new landscaped median construction to a depth of two feet (2') below the new pavement elevation, to allow for fill with imported topsoil for landscaping, shall be measured and paid for as roadway excavation. Material to be removed may include existing pavement, existing base material, existing soil and new fill material up to the elevation of the new roadway surface placed to construct the new roadway.

No additional compensation will be allowed for proof rolling subgrade as directed by the City.

No additional compensation will be allowed for removing unsuitable material from the work site.

No additional compensation will be allowed for placing unsuitable material in the roadway embankment.

Payment for geotextile fabric used in the backfill of unacceptable material encountered during roadway excavation for roadway construction will be paid for as detailed in Section 18-5.05, "Unsuitable Material Excavation - Payment", in this Section of these Specifications.

## **18-3 STRUCTURE EXCAVATION AND BACKFILL**

### **18-3.01 General**

Structure excavation and backfill shall conform to Section 19-3, "Structure Excavation and Backfill", of the State Specifications, and these Specifications. Structure excavation and backfill shall include all necessary excavation, structure backfill, and pervious backfill within the limits set forth on the Plans, Standard Drawings, and in the Special Provisions.

Unless otherwise specified in the Special Provisions, jetting of structure backfill will not be permitted.

### **18-3.02 Control Density Backfill**

Control density backfill will be permitted when specified in the Special Provisions or when written permission is given by the Engineer. Where permitted, control density backfill shall conform to the requirements of Section 50-15, "Control Density Fill/Controlled Low Strength Material", of these Specifications.

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### **18-3.03 Final Quantity**

The quantity of structure excavation shown on the Plans and in the Estimated Quantities will be the final quantity for which payment will be made as provided in Section 9-1.02C, "Final Pay Item Quantities", of the State Specifications.

### **18-3.04 Measurement and Payment**

Measurement and payment for structure excavation and backfill will be as set forth in Section 19-3.04, "Payment", of the State Specifications, and these Specifications.

The Contract price per cubic yard for structure excavation includes full compensation for all necessary excavation, structure backfill, and pervious backfill within the limits set forth on the Plans, Standard Drawings, and in the Special Provisions.

When removing an existing structure which is to be replaced with a new structure, no payment will be made under this item for the area occupied by the existing structure.

## **18-4 DITCH AND CHANNEL EXCAVATION**

### **18-4.01 General**

Ditches and channels shall be excavated to line and grade and sections as shown on the Plans. Material resulting from excavating ditches and channels shall be used in fill and embankment areas as shown on the Plans.

### **18-4.02 Grade Control - Lined Channels**

The Contractor shall place grade control points at twenty-five-foot (25') intervals along the invert of the shaped channel. For channels greater than twelve feet (12') wide, the Contractor shall place grade control points at twenty-five-foot (25') intervals along each edge of the bottom. Care shall be taken to prevent excavating below the channel grade line or beyond the slope lines. Areas excavated below grade or beyond the slope shall be filled with suitable materials, as determined by the City, and compacted to ninety three percent (93%) relative compaction by the Contractor at the Contractor's expense.

### **18-4.03 Unsuitable Ditch and Channel Excavation and Backfill**

Any unsuitable material encountered shall be removed and backfilled in accordance with Section 18-5, "Unsuitable Material Excavation", in this Section of these Specifications.

### **18-4.04 Unsuitable or Surplus Material Disposal**

Unsuitable or surplus material excavated as channel excavation which, in the opinion of the City, cannot be worked into the required embankments, shall become the property of the Contractor and shall be disposed of as specified in Section 18-7, "Surplus Material Disposal", in this Section of these Specifications, unless otherwise specified in the Special Provisions.

### **18-4.05 Channel Backfill**

In those areas where the bottom of the existing channel is below the proposed grade or beyond the slope lines, the Contractor shall fill and compact these areas to a minimum

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ninety three percent (93%) relative compaction with suitable material, as determined by the City. No additional payment will be made for this work, as it shall be considered as included in the Contract price for channel excavation.

### **18-4.06 Channel Embankments**

Embankments shall be placed as shown on the Plans. Embankment areas shall be filled with suitable material, as determined by the City, resulting from channel excavation. The fill shall be placed in a neat and uniform manner, and shall be spread uniformly to the grades as shown on the Plans. Where embankment is made on the existing channel or on other slopes, the existing slope shall be plowed or cut into as the embankment is constructed so as to tie the new embankment to the existing slope. All fill slopes shall be trimmed for a uniform appearance. Fill areas in unlined channels shall be compacted to a minimum relative compaction of ninety three percent (93%), unless otherwise shown on the Plans.

In lined channels, fill areas shall be compacted to a minimum relative compaction of ninety three percent (93%) to an elevation one foot (1') above the top of the channel lining, unless otherwise shown on the Plans.

Localized erosion, sloughing or other slight irregularities in the existing channel which may occur between cross-sections, may not be shown on the Plans or cross-sections. Where the localized erosion, sloughing or irregularities extend beyond the limits of the channel cross-section, these areas shall be filled and compacted to conform to the design channel cross-section. No additional payment will be made for these fills.

### **18-4.07 Pipe Adjustments**

Side drain pipes without racks or flap gates shall be extended or shortened as required to discharge into the new channel so that the pipe outlet is flush with the channel slope in conformance with Standard Drawing SD-26. The pipe used for extending existing side drains shall be of the same diameter as the existing pipe, and shall conform to one of the options specified in these Specifications.

The method of placing pipe extensions shall conform to these Specifications and the Standard Drawings. Existing side drain pipes to be shortened shall be neatly cut off parallel to the slope of the channel.

## **18-5 UNSUITABLE MATERIAL EXCAVATION**

### **18-5.01 General**

Unsuitable or unacceptable material encountered in the construction of roadways shall be removed as roadway excavation and backfilled as detailed in Section 18-2.05, "Subgrade Preparation", in this Section of these Specifications.

Unsuitable material is that material determined by the City to be unsuitable in its natural location and condition for roadway, channel, or structural foundation.

The Contractor's method of excavating unsuitable material shall not undermine the existing base material. If, in the opinion of the City, the Contractor's method of excavating is increasing the amount of unsuitable material required to be excavated, the City will require the Contractor to take the necessary steps to correct the condition at the Contractor's expense.

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### **18-5.02 Backfill**

Backfill to replace unsuitable materials shall be placed and compacted to a minimum relative compaction per Section 18-2 on roadways and structural foundations.

Suitable backfill material shall be one of the following:

1. Pit run materials as specified in Section 50-8, "Pit Run Base (Graded)", of these Specifications.
2. Roadway excavation, structural excavation, or channel excavation material approved by the City.
3. Imported borrow as specified in Section 18-6, "Imported Borrow", in this Section of these Specifications.
4. Cobbles as specified in Section 50-9, "Cobbles", of these Specifications.
5. Geotextile fabric as specified in Section 50-10, "Geotextile Fabric", of these Specifications, and backfilled with Class 2 aggregate base.
6. Any approved combination of 1, 2, 3 and 4 above.

### **18-5.03 Geotextile Material**

The need for this item is contingent upon the need to stabilize unsuitable basement material encountered during construction and may be extended or deleted at the discretion of the City. The material required "fabric or geogrid will be determined by the Engineer and shall be as specified in Section 50-10 "Geotextile Fabric", of these Specifications.

Geotextile material at the overlap shall be either lapped a minimum of eighteen inches (18") or sewn or glued if fabric is used. If lapped, the geotextile material shall be placed so that the preceding roll overlaps the following roll in the direction the fill backfill material is being spread. If sewn or glued, the seam strength shall not be less than ninety percent (90%) of the required tensile strength of the unaged fabric. The surface to receive the geotextile material shall be prepared to a smooth condition free of obstructions and debris that may damage the geotextile material during installation. Geotextile fabric shall be furnished in a protective wrapping that shall protect the fabric from ultraviolet radiation and from abrasion due to shipping and handling. The geotextile material shall be covered with the fill material within two (2) calendar days of its placement. Should the geotextile material be damaged during construction, the torn or punctured section shall be repaired by placing a piece of geotextile material that is large enough to cover the damaged area and to meet the overlap requirement.

### **18-5.04 Approximate Quantity**

Where a quantity is shown in the Contract for unsuitable material excavation, the quantity shall be considered as approximate and is indicated for bid comparison only. No guarantee is made or implied that the quantity shown will not be reduced or increased or deleted, as may be required by the City. See Section 9-8.02, "Payment for Changes - Unit Prices", of these Specifications.

### **18-5.05 Payment**

The additional excavation greater than that required for preparation of original ground

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or subgrade will be paid for at the Contract unit price per cubic yard for the various types of excavation involved. Unsuitable material excavated more than two feet (2') below subgrade shall be paid for as extra work as provided in Section 9, "Changes and Claims", of these Specifications if no item for unsuitable material excavation appears in the Contract.

Backfill, when made with material excavated from the work site, will be paid for at the same Contract unit price paid for roadway excavation or channel excavation, whichever applies. The pay quantity will be the same as that quantity computed for unsuitable material excavated.

Imported borrow, pit run material and cobbles, and the placing of such materials, will be paid for as specified in these Specifications for those items.

The quantity of geotextile fabric to be paid for will be measured by the square yard of area covered, not including additional fabric for overlap. The Contract price paid per square yard for the geotextile includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals. The price per yard also includes doing all work involved in placing the geotextile, complete in place, as directed by the City. The need for this item is contingent upon the need to stabilize unsuitable base material encountered during construction and may be extended or deleted without limit at the discretion of the City with no change in the Contract unit price.

Should the Contractor elect to place cobbles or other material in the channel bottom to provide a working surface, in lieu of de-watering the channel, the cost of furnishing and placing such material shall be at the Contractor's sole expense.

### **18-6 IMPORTED BORROW**

#### **18-6.01 General**

Imported borrow shall consist of material required for the construction of embankments and shall be obtained from sources listed in the Special Provisions or, if no sources are listed, from sources the Contractor may elect. The Contractor's sources shall be approved in advance by the City. Imported borrow shall be free of roots, vegetable matter, and other unsatisfactory material, and be of such character that it will readily bind to form a firm and stable embankment when compacted.

The imported borrow material shall have a sand equivalent of not less than the average sand equivalent of the native material that is adjacent to the existing roadbed, and an R-value of not less than 20, or as otherwise specified in the Special Provisions. Clayey soils shall not be used. Imported borrow material shall be tested prior to being transported to the project site. Contractor to provide certification of suitability by a geotechnical engineer prior to start of earthwork. Testing of imported fill shall be the responsibility of the Contractor.

If no item for imported borrow appears in the Contract, the earthwork shall be considered balanced with no imported material required. If the City deems it necessary to place imported borrow due to field conditions, shrinkage, or swell factors experienced, the imported material shall be furnished and placed as extra work, as provided in Section 9, "Changes and Claims", of these Specifications.



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### **18-6.02 Agreements**

The Contractor shall enter into an agreement with the property owner of any privately owned material site to hold said owner harmless from any claims for injury to persons or damage to property resulting from the Contractor's operations on said property. The agreement shall contain provisions to relieve the City of any obligation to the property owner or claims for injury or damage of persons or property. A copy of the agreement shall be furnished by the Contractor to the City a minimum of two (2) working days prior to commencing operations at the material site.

### **18-6.03 Placement**

The imported borrow material shall be placed and compacted as specified for roadway embankment.

## **18-7 SURPLUS MATERIAL DISPOSAL**

### **18-7.01 General**

Surplus materials, resulting from excavations that are not required for backfill or embankment construction or to satisfy right-of-way agreements as set forth on the Plans and in the Special Provisions, shall become the property of the Contractor, and the Contractor shall dispose of the surplus materials off the rights-of-way or easements, unless permitted by the City to be disposed of on the work site.

### **18-7.02 Agreement**

When any materials are to be disposed of outside the rights-of-way or easements, the Contractor shall obtain written permission from the property owner upon whose property the disposal is to be made. The Contractor shall also enter into an agreement with the property owner to hold said owner harmless from any claims for injury to persons or damage to property resulting from the Contractor's operations on said property. The agreement shall contain provisions to relieve the City of any obligation to the property owner for any injury or damage to persons or property. The agreement shall also include a sketch showing the location where the material is to be deposited. A copy of the permission obtained from the property owner and the agreement shall be furnished by the Contractor to the City a minimum of two (2) working days prior to commencing disposal operations. Excess materials shall not be deposited in any location that will block or restrict a natural or artificial drain. No material shall be deposited within the dripline of certain ornamental, landmark, and native oak trees, as specified in Section 10-13, "Protection of Existing Trees", of these Specifications.

### **18-7.03 Permits**

The Contractor or owner of the property where excess material is to be deposited shall be responsible for obtaining all required permits from any agency which may have jurisdiction over the proposed disposal site.

When any materials are to be disposed of outside the right-of-way or easements which would affect any waterway, the Contractor shall obtain a permit from that City, in addition to the property owner agreement as set forth above.

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In addition to any permit required by the City, disposed of material shall also conform to the applicable City grading ordinances. The Contractor or the owner of property on which material is to be disposed of shall obtain a grading permit, if required, prior to disposal of any excess excavated material.

Copies of any required permits shall be furnished to the City. No permits will be required if disposal sites are shown on the Plans unless otherwise specified on the Plans or in the Special Provisions.

Prior to placing any material within the 100-year floodplain of any acknowledged natural streams as adopted by Council, the Contractor or property owner shall first obtain a Use Permit from the Planning Department.

### **18-7.04 Payment**

No separate payment will be made for disposal of surplus material and all compensation therefore is included in payment for other earthwork items.

## **18-8 CLASS "C" SUBGRADE**

### **18-8.01 General**

Those areas of existing pavement as shown on the Plans or as directed by the City to receive an overlay of asphalt concrete shall be prepared as Class "C" subgrade. Class "C" subgrade shall apply to subgrade prepared on an existing roadbed, subbase, base, surfacing or pavement which was not constructed by the Contractor, and on which a layer of subbase, base, surfacing, pavement, or other specified material is to be placed.

### **18-8.02 Preparation**

In advance of spreading new subbase, base, surfacing or pavement material, the existing roadbed, subbase, base, surfacing or pavement shall be cleaned of all dirt and loose material.

If ordered by the City, a leveling course of material to be placed shall be spread upon the existing roadbed, subbase, base, surfacing, or pavement, in accordance with the specifications for the type of material being placed.

Where shown on the Plans or specified or directed by the City, the existing roadbed, subbase, base, surfacing or pavement shall be scarified, watered, and rolled in advance of placing new material thereon.

Broken, failed or other unsatisfactory portions of the existing roadbed, subbase, base, surfacing or pavement, and sections interfering with new construction shall be removed and disposed of. The areas and depths to be removed shall be as ordered by the City. The area in the exposed spaces shall be watered and compacted, after which the space shall be filled with subbase, base, surfacing or pavement material as directed by the City.

### **18-8.03 Payment**

Unless otherwise specified in the Special Provisions, the excavation and disposal of existing pavement other than that shown on the Plans to be excavated as a part of, or adjacent to, an area to be excavated to provide a new structural section, will be paid for as

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extra work as provided in Section 9, "Changes and Claims", of these Specifications.

Excavation of pavement and materials shown on the Plans necessary for preparation of Class "C" subgrade will be paid for as roadway excavation as set forth in Section 18-2.06 "Roadway Excavation - Measurement and Payment", in this Section of these Specifications.

Full compensation for furnishing all labor, material, tools, equipment, and incidentals and for doing all the work involved in preparing Class "C" subgrade, including the leveling course, excluding excavation, as shown on the Plans, specified in these Specifications or the Special Provisions, or as directed by the City, is included in the Contract prices paid for the materials, in place on the subgrade as shown on the Plans, or directed by the City.